

John Williams

Agricultural Supply Chains and the Challenge of Price Risk



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AGRICULTURAL SUPPLY CHAINS AND THE CHALLENGE OF PRICE RISK

This book discusses the issues of integration within food and fibre supply chains and the challenges in managing price risk. The problems of integration and price risk are interwoven in agricultural supply chains with production and supply risk as well as hoarding. However, without supply chain integration through commercial trade markets there can be no forward market upon which forward transactions and the management of price risk can be based. Without a forward market that can reduce opportunistic behaviour, there is likely to be little security of supply, particularly under high production risk and price uncertainty.

Whilst price risk management is possible under certain circumstances, there are many factors that can prevent the development of forward markets or cause them to collapse, thus undermining the ability to manage price risk within acceptable risk and return parameters. Market positions therefore need to be valued and often settled daily due to the risk of contract default. In addition, the issue of currency risk and its management applies to international market positions and transactional exposures.

The book analyses a range of price risk management strategies from forward contracting through to futures and options hedging, and finally to over-the-counter products. Evaluation techniques are developed to aid decision-making. The author concludes that forward market development may be the exception rather than the norm, and that whilst favourable price risk management outcomes may be possible, they can sometimes be caused more by luck than through good management. It is shown how tactics are an important consideration in decision-making to minimize costs and losses.

John Williams is Executive Director of the Food and Fibre Supply Chain Institute, Senior Researcher and Consultant at the Australian Commodity Research Institute, Member of the Institute of Public Affairs, and Fellow in Agribusiness at Marcus Oldham College, Geelong, Australia. He is the author of *Competition and Efficiency in International Food Supply Chains* (Routledge, 2012), which was shortlisted for the 2013 Commodity Business Award: Commodity Market Policy & Advisory Award.

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John Williams

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CONTENTS

<i>Preface</i>	<i>vii</i>
<i>Acronyms</i>	<i>ix</i>
Introduction	1
1 Integration and forward contracting	5
2 Forward markets	26
3 Problems with risk management	44
4 Position, default, and valuation	58
5 Futures hedging and effectiveness	80
6 Options hedging and price enhancement	102
7 Over-the-counter pricing products	128
8 Tactics and evaluation	145
9 Postharvest issues	170
10 Currency and risk management	193

vi Contents

11 Limitations in managing risk 212

12 Arbitrage and spread trades 228

Conclusion 241

Notes 245

Glossary 281

Index 289

PREFACE

This book completes a trilogy that began 20 years ago in the aftermath of grain and wool supply chain deregulation in Australia. Many presumed that the formation of a local grain futures exchange in 1996 would reduce supply chain risk and add security to food value chains. What was generally ignored was an explanation of why the wool futures market had failed to prevent wool regulation during the 1970s and 1980s after the Sydney Greasy Wool Futures Market commenced in 1960.

The first book *Agricultural Price Risk Management* by John Williams and William Schroder (Oxford University Press, 1999) established the theoretical principles of managing price risk and the different local market mechanisms, with particular application to postderegulatory Australian supply chains. There was still the expectation that increased knowledge would assist the adoption of better local management practices to minimize food and fibre supply chain risks. The euphoria of finally having a local grain futures market masked many of the underlying problems, one of which was the existence of various grain export single-desks for another 12 years. Forward market constraints soon forced risk managers back onto international futures markets such as Chicago, which reintroduced the risk management problems of relevancy, parallelism between markets, and currency risk.

Holbrook Working had dominated the agricultural forward market debate for storable products from the 1920s to the 1960s in both the USA and England. There was great emphasis on how commercial trade markets were supposed to develop forward markets that should evolve into

futures markets for the purpose of price risk management. Issues such as risk attitudes, risk management adoption problems under uncertainty, as well as parallelism and currency risk had been examined in Australia prior to deregulation by David Rutledge in the 1970s, as well as Gary Bond and Bernard Wonder in the 1980s. At the same time in the USA, Dennis Carlton and Anne Peck were identifying some of the reasons for the success and failure of futures markets. There was a need to synthesize these findings.

The second in the trilogy *Competition and Efficiency in International Food Supply Chains* by John Williams (Earthscan-Rutledge, 2012) focused on the problems in developing commercial trade markets and integrative forward markets in many countries. Many factors can preclude the effective functioning of forward markets including price distortions, supply chain dysfunction, commingling and commoditization, hoarding and pooling, and corruption. Government policy has an important noninterventionist role in both the development and sustainability of forward markets.

Some have argued that if forward markets and risk management are so difficult, then why bother? That dilemma was resolved by Holbrook Working 80 years ago when he associated forward markets with supply chain security. Whenever strong commercial trade markets lead to forward markets, then agricultural product will be carried forward and provide product availability to the supply chain when needed. Without strong commercial trade markets and integrative forward markets, supply chains can be reduced to opportunistic behaviour with periodic dumping or shortages, which can be worsened by government buying and selling.

This third book focuses on the issues of forward markets, how they work, their function, and why they frequently fail. It explains why risk management succeeds or fails based on the effectiveness of the forward market to offset risk and to provide efficient price signals. The book will explain why supply chain management is interwoven with the management of price risk.

Because effective forward markets can only be established for storable products, the book will be confined to grains, fibre, sugar, coffee, cocoa, animal feed, pulses, vegetable oils, concentrated fruit juice, and dried-dairy products. The application to animal products in some instances will be discussed in Chapter 11.

ACRONYMS

AA	Against Actual
APW	Australian Premium White wheat
ATM	At-the-Money
AUD	Australian dollar
BRL	Brazilian real
CAD	Canadian dollar
cif	Commission (cost), insurance and freight or destination port price
CME	Chicago Mercantile (Exchange) Group
EFP	Exchange for Physical
FEC	Forward Exchange rate Contract (also known as foreign or fixed)
fob	Free-on-board (ship) or origin port price
GMP	Guaranteed Minimum Price contract
HTA	Hedged-to-Arrive contract
ICE	Intercontinental Exchange
ITM	In-the-Money
JIT	Just-in-Time
OTC	Over-the-Counter
OTM	Out-of-the-Money
P/L	Profit/Loss

✕ Acronyms

RP	Realized Price
ROC	Rate of Change
RSI	Relative Strength Index
USA or US	United States of America
USD	United States dollar

INTRODUCTION

Uncertainty, risk, and their associated tradeoffs may be the grist for risk psychologists, but the biological uncertainty of agricultural products makes it even more so. Decision making under high uncertainty is prone to frequent mistakes, yet risk management is expected to occur under such adverse circumstances.

There are many functions of price within the supply chain which are frequently destroyed by those who seek to control it through some theoretical equilibrium optimum. Price needs to be separated from pricing in risk management, which has a time factor involved and therefore requires a forward market based on a strong underlying commercial trade market with a sufficient volume of transactions.

There is often a naive perception that such commercial trade markets and forward markets will automatically develop after deregulation has occurred in the supply chain, and that the management of risks within the supply chain, such as price risk, is relatively easy with few tradeoffs. However, the rhetoric rarely matches the reality, with many impediments to integration and management.

Integration within food and fibre supply chains can exist either with vertical ownership or contractual agreements that establish commercial trade markets. Vertical ownership usually requires large investment risk, while commercial trade markets may not be permanent and be frequently unsustainable. The alternative to supply chain integration or commercial trade markets is opportunistic buying and selling behaviour in the spot market.

2 Introduction

However, vertical ownership, commercial trade markets and opportunism may co-exist during times of surplus product and seemingly support food and fibre security.

The problem with commercial trade markets is that they are prone to collapse whenever shortages occur, yet they are essential for the establishment of forward markets that can facilitate forward risk management. Without a strong underlying physical forward market, agricultural futures markets are likely to be ineffectual, which then limits the effectiveness of hedging price risk.

Despite the negative impact of direct government intervention on commercial trade and forward markets, there is a definite role for government in ensuring efficiency in supply chains and effectiveness of forward markets. The problem for governments is balancing between under-regulating and excessive intervention, particularly when public institutions need food and fibre procurement. Also, there needs to be strong legal enforcement, but within the confines of functionality and efficiency.

There are many prerequisites for the development of a forward market, which can then lead to many benefits in the supply chain. However, effective forward markets do not simply evolve, and much effort is required to ensure their trading success as their failure rate is extremely high. Even when effective forward markets are established, misinterpretation of forward market signals can be the cause of many errors in strategy selection and implementation.

Supply chain transactions can be so intricate that misinterpreting market position can lead to unexpected risk or wrong strategy implementation. What may appear straightforward in a simple forward transaction can result in confusion over market position when contract default occurs. It might be argued that risk management can be simplified if the correct market position can be identified and understood. However, whilst the retention or transfer of ownership title is vital to market position exposure, it is frequently obscure.

The possibility of agricultural supply default must be taken into account to determine potential market position exposure, otherwise future business operations may be jeopardized. Minimizing the potential and impact of supply default is an important yet uncertain management requirement. Understanding how market position is valued is a vital component of supply chain risk and its subsequent management.

Inadequacies in contractual relationships in food and fibre supply chains inevitably lead to finding other solutions to manage risks such as price risk. The mechanism of price hedging evolved from forward contract default

and has led to the sequential development of futures markets, options markets, and finally over-the-counter products. But there is no panacea for risk management remedies because of risk tradeoffs and transaction costs. Each price risk management strategy has its strengths and weaknesses. Much depends on timing and alignment with efficient forward market signals.

Physical supply is the foundation of food and fibre supply chains. It might be expected that much supply chain risk would be eliminated once harvesting occurs. However, production rarely equates to supply. Emotions, psychology, and group dynamics interweave during and after harvest to prevent the supply of much product to buyers because of price. Many governments even become involved through public hoarding or subsidizing private hoarding. Group pooling and private hoarding are frequently used in lieu of alternate strategies to enhance price postharvest. This delay in product sale has important implications to the ever increasing concern over food biosecurity and supply chain security.

Currency risk is largely neglected whenever government intervention occurs, or in the USA where most international transactions occur in US dollars. This explains the absence of currency discussion in most of the relevant US literature. However, supply chain deregulation has increased the awareness of currency risk both in international and domestic transactions, particularly when ineffectual domestic forward markets cause reliance on international price benchmarks and foreign hedging mechanisms. Currency risk can require adequate risk management strategies to minimize the risk.

There is much presumption that futures markets will always operate effectively to enable physical delivery against the forward contract or to transfer price risk. Agricultural futures markets are only as strong as the underlying commercial trade market. Any weakness in the underlying supply chain can result in serious deficiencies in the futures market which spill over into risk tradeoffs and higher transaction costs. Mandating the cash settlement of forward contracts can be an admission of failure of an effective underlying physical delivery system. Failure of deliverable forward contracts can be synonymous with the failure of price risk management. Attempting the impossible out of an impossible situation rarely benefits anyone other than speculators.

Arbitrage may be vital for international trade, but arbitrage strategies are essential to ensure efficiency in price signal transmission in food and fibre supply chains. Without adequate and regular arbitrage to remove price discrepancies, such temporary discrepancies can become more permanent price distortions, which can lead to political lobbying for government intervention under the mistaken guise of market failure.

4 Introduction

This book is structured to reflect such weakness within food and fibre supply chains, which thereby causes many of the shortcomings in managing price risk. Some might inadvertently conclude that the management of price risk has failed without considering the fragility of agricultural supply chains, the impossibility of controlling supply, and the positive skewness of agricultural prices.

An ability to control supply should lead to greater supply chain integration, which would contribute to less risk associated with price risk management, and which presumably could increase the adoption of price risk management practices. However, controlling agricultural supply has eluded most countries for much of history. Therefore weaknesses in managing price risk will remain with the uncertainty of agricultural supply and the skewness of prices, rather than be caused by any market failure per se. This book is rather unique in focusing on these issues, which will lead to some important conclusions.

1

INTEGRATION AND FORWARD CONTRACTING

Agricultural production is usually expected or assumed to always have a buyer. Consumers are generally expected to always need or be eager to buy what is produced. Rarely is it considered that much of what is produced is not what buyers or consumers want. Some farmers even expect tax-payers to buy whatever surpluses that consumers do not want.

Exact alignment of agricultural production with consumption rarely occurs. Much food and fibre is produced opportunistically in the hope that there is a buyer. Unsold food and fibre languishes in global storage, isolated from buyers and consumers. Even much food that has been sold into the supply chain is often wasted and not consumed.

Such misalignment can result from the long time lags involved with seasonal agricultural production, and is aggravated by continual changes in consumer tastes, technology, biology, and weather conditions.¹ Both supply chains and markets are driven by uncertainty.²

Food and fibre supply chains are also characterized by the dynamics of change in production operations and business relationships,³ international competitiveness,⁴ and the continual movement of international prices that are exacerbated by exchange rate relativities. Also, farmers can be both suppliers and consumers of farm outputs and inputs irrespective of the economic status of the country.

Supply chains invariably fail if the willingness of consumers to buy and consume is not matched by the willingness and ability of farmers to produce and supply the associated product.⁵ Failure within supply chains can be

6 Integration and forward contracting

measured by unwanted surpluses, the incidence of contract default caused by production shortfalls,⁶ and the unwillingness of hoarders to supply.⁷ The fickleness of consumers⁸ and the inelasticity of supply⁹ can be contributing factors.

Given such dynamism and uncertainty, agricultural supply chain contractual obligations rarely extend more than 12 months except under vertical ownership or renegotiation. Risk usually increases with contract rigidity in the supply chain, which can necessitate a reduction in the time of contractual commitments and an increased need for flexibility.¹⁰

Determining some comparative advantage and the probability of risk might be considered essential before buyers and sellers commit to integrative contractual relationships. Yet these are rarely determined because of the difficulty in identifying inherent advantages¹¹ and controlling the risks.¹² Basic emotions such as hope, opportunism, and profit expectations¹³ still drive much of the supply chain integration under dynamic uncertainty rather than any longer-term commitment to sustainable relationships. This is particularly the case for farmers struggling with low profitability and for those supply chain intermediaries with expectant and anxious shareholders.¹⁴

Integration can conceptually range from short term with alliances to long term under ownership. The capital investment associated with a joint venture usually differentiates it from a strategic alliance that may have no capital commitment.¹⁵ There may be forward integration towards the final consumer, or backward integration towards the farmer.

Specialization of integrated supply chains¹⁶ makes it extremely difficult to benchmark efficiency and performance. One objective measure of supply chain efficiency is the existence of a forward market to facilitate forward transactions and to manage risks within the supply chain.¹⁷ However, such forward markets are dependent on market liquidity, which is sometimes only bolstered by the inclusion of nonphysical participants such as speculators.

Perspectives on integration

A food processor once had a potato supply chain that was perceived to be fully integrated with carefully selected farmer suppliers in a rainfall-secured region. The processor provided the specific product seed varieties, the required agronomic inputs, and the agricultural advice to the farmer, as well as buying all the potatoes that the farmer produced at a pre-arranged contract price that was largely determined by another contract between the food processor and a fast-food retailer.

The question arose as to why this supply chain integrative model could not be applied to other input supplies for the food processor, such as grains and oilseeds. If potato farmers could integrate with food processors through such differentiated products, then what factors were stopping grain and oilseed farmers from doing likewise?

Certain risk parameters of the food processor needed to be known to answer this question. The risk of failure to deliver had been prior determined by the risk policy committee of the food processor at 10 percent. This meant that the food processor had to be assured of delivery of the required product no less than 90 percent of the time. The worst-case scenario for the food processor, which was when major financial losses and factory stand-downs occurred, was when supply and delivery default reached 20 percent.

Such risk policies provide the answer to the food processor question. If individual farmers have more than a 10 percent probability of not being able to deliver grain or meet product specification, then food manufacturers probably will not undertake a supply agreement with individual farmers under such high-risk conditions.

Many farmers have a high probability of not meeting consistent delivery and product specifications, particularly in marginal production regions. End users are more likely under such high risk to adopt opportunistic speculative spot purchase behaviour,¹⁸ but even that assumes that they would undertake high capital investment in such marginal regions.

An alternative strategy available to the food processor or manufacturer is to form contractual relationships with one or more domestic merchants who can accumulate from many diverse regions and deliver the required product when needed. This relationship is often established as a commercial trade market, and it is mutually dependent in that the end user needs the merchant for the purpose of accumulating, warehousing, financing, and delivering the specified product, whereas the merchant relies on the end user for maintaining profitability.

The formation of such commercial trade markets can be perceived to alienate farmers because of selectivity and exclusivity.¹⁹ End users need specific product and reject nonspecific product. Given the risk probabilities with biological agricultural production, luck can be largely associated with product acceptance and bad luck with product rejection. If a farmer through no fault of adequate farming practice produces a biological product that does not meet end user specification, the subsequent rejection can devastate farmer morale and induce anger. Marginal soil or uncertain rainfall regions are unlikely to be selected for supply chain integration because of this improbability of supply guarantee.²⁰

8 Integration and forward contracting

Whilst the potato supply chain model is theoretically ideal, most farmers and end users do not have such integrative advantages or opportunities. The end user is more likely either to have commercial trade agreements with merchants to cover their input supply requirements for the next 12 months, or alternatively, they opportunistically use the spot market to purchase the required product just in time (JIT).

Even the potato supply chain model proved to be unsustainable. Rising farm costs and currency exchange rates ultimately meant that it was far cheaper for the food processor to import potatoes and not integrate with local farmers. Dynamic change and the need for flexibility mattered more than long-term integration. Relative costs, prices, and exchange rates are important considerations in supply chain integration decision making. Any government intervention in supply chains under such circumstances is highly likely to lead to end users either closing operations or avoiding new capital investment, both of which can devastate domestic supply chains and make them import-dependent.

Markets and uncertainty

Markets require a foundation or physical base such as an agricultural commercial trade market that is part of an intricate food or fibre supply chain. Even indices such as the Commodities Index must be based on a composite of many smaller markets. Any attempt to establish a virtual market such as a forward market for perishable products which is not derived from underlying physical transactions can be reduced to being speculative and will most likely be unsustainable.²¹

Spot markets reflect some urgency and immediacy for buyers and sellers to transact,²² perhaps because of product perishability, or requirement for cash flow, or a need to satisfy manufacturing throughput or customer demand. Alternatively, forward markets are transactions at some future time, where time has some value relative to a spot transaction.

Buyer and seller integration drives market strength.²³ Greater urgency and immediacy to transact in either spot or forward markets will drive market liquidity, which can be measured by the daily volume of transactions, the depth of bids and offers at prices above and below the current market price, and the number of forward contracts established.

Uncertainty drives supply chain integration and creates markets. Market volume can be determined by the number of buyers who think that prices could rise being equally offset by the number of sellers who think that prices could fall. Ironically, information can frequently cause uncertainty over

conflicting and untimely data, and paradoxically may create market liquidity through contrary behaviour.²⁴ Different price sentiments in different time frames together with the need to transact physical products combined with opportunism and expectations of profit drives market liquidity.

In contrast, supply and demand certainty can jeopardize both spot and forward markets. If everyone thought that prices were going to rise in the future, there would be no sellers of storable products and no market as reflected in transactional liquidity, except for perishable products. Alternatively, if everyone thought that prices were going to fall in the future, there would be no immediate buyers and again any market would be jeopardized, regardless of whether the product was perishable or storable.

The certainty of price under monopoly or government price control in countries such as India is likely to destroy the functionality of market signals and cause product hoarding in an attempt to force prices higher as well as price manipulation to profit from opportunities, both of which can lead to supply chain corruption.²⁵ Hoarding causes end user supply frustration and is a symptom of the supply chain problem, not the cause of it.

The importance of price

The absence of a price mechanism reduces farmers to subsistence, with any transactions confined to bartering or countertrade. It is price that lifts farmers from subsistence into the cash economy. Belittling price can result in entrenching poverty and perpetuating primitive supply chains.

Some argue that price is not important in the global food security debate. However, price and associated price signals shift farmers from subsistence into a cash economy in which surpluses are more likely to be produced. Price can undermine food production sustainability because of its impact on farm profitability. Supply chain efficiency is dependent on transparent and accurate price signals. Contract price was the essence in the potato supply chain case study, and it was price that caused the dissolution of the supply chain integrative relationship.

Agricultural production should not occur without a value being attached by consumers or customers. In economies that have been ravaged by corruptive distortions and bureaucratic restrictions, value might be restricted to the immediacy of feeding the farming families. Value might be the opportunity cost of pricing and income foregone.

Once basic food necessities to overcome hunger are satisfied, price is the motivator to produce, to sell, to invest, and to buy. The corollary suggests that if the price mechanism is destroyed or distorted, then farmers will be

10 Integration and forward contracting

reduced to subsistence and be isolated from the cash economy and longer-term sustainability. This has implications for policies involving government intervention, hoarding, corruption, and prolonged 'aid'.²⁶

If costs of production and capital investment are considered important factors in the global food security debate, then price must be elevated in relative importance. It is the price of inputs that drives the cost of production and often the usage of inputs. As well, it is the price of money as reflected through interest rate movement that determines the amount of capital investment. Such price importance suggests that there may be a need to manage price.

Price is important in supply chain decisions because of the value signals to farmers, merchants, end users, and consumers. Changes in supply and demand need to be transmitted quickly and efficiently to relevant decision makers through price movement, otherwise the supply chain becomes dysfunctional. Price is likely to be more transparent in concentrated commercial trade markets than it is in more decentralized and diverse supply chains.

A forward price is the foundation of commercial trade relationships, and without a forward price, all commercial trade could be reduced to spot market opportunistic transactions. Forward prices reflect the eagerness of end users and merchants to establish commercial trade markets.

The role of buyers and sellers in establishing price depends on the transaction method. A silent or auction market can be devoid of all seller presence, other than to prior establish a minimum price for a spot sale. This contrasts to a commodity exchange whereby buyers, sellers, and their agents can actively transact in spot and forward months. These transactions are non-integrative and opportunistic, and can be contrasted with commercial trade markets that are more integrative with business relationships.

Buyers can bid in active competition, whereas both buyers and sellers can passively offer a price under less competitive circumstances. Offering a price is usually undertaken by sellers who are desperate to become price makers when there is little buyer activity and previous opportunities are gone. Buyer bidding activity is more likely to peak before or at harvest, but then fall quickly away as product life becomes both uncertain and shortened. Product certainty may only exist at harvest time, which explains why it is essential for sellers to facilitate maximum buyer competition, and not to destroy this competition.

Cost, price, yield, and acreage are the primary determinants of farm income and profitability. The greater the dependence on a single price through product specialization, the higher may be the profit risk. In contrast,

enterprise diversification tends to lessen the importance and spread the risk of any singular price. Therefore, product specialization can increase price risk relative to product diversification.

However, it is still debatable as to whether product or price should be the most dominant in decision making, or whether there is a sequence. There cannot be a supply chain without product, but there may be no product without adequate price. The answer probably lies with price driving product decisions, irrespective of whether it arises from the buyer or seller perspective, with the importance of pricing increasing after the decision to produce has been made. Pricing can become more important as product becomes more certain, but this may depend on price movement. Confusion may arise if price is not distinguished from pricing.

The value of a product to a buyer is reflected in its price. Some buyers perceive a high-priced product to be good value, whereas other buyers might perceive a low-priced product to be good value. Buyers can be classified as niche buyers who may be very discerning and price making, or volume buyers who are less discerning and may be opportunistic buyers of last resort through price taking. Niche buyers may have large risk capital investment, whereas volume buyers might have lean low-debt operations.

Niche price-making buyers are more likely to occur before or at harvest, whereas price-taking volume buyers are likely to occur very opportunistically after harvest. The dilemma for farmers is that price-making opportunities usually coincide when there is product uncertainty, whereas price-taking problems usually occur when there is product certainty. Pooling, hoarding, or government intervention will never solve this farmer dilemma.²⁷

Hoarding psychology is greatly influenced by price.²⁸ If prices are not perceived to be 'fair',²⁹ then some farmers will go to extraordinary lengths to withhold supply from merchants and end users, regardless of cash flow and debt problems. What is produced may be totally disparate to that being supplied.

Even when prices may be deemed 'fair', this is no surety that farmers will sell, because increasing price encourages even greater hoarding under the old adage of why sell today when prices are going to be higher tomorrow. Price, production, supply, and global food security are intricately linked.

As products move along the spectrum from differentiated product at harvest towards undifferentiated commingled commodity in storage, price becomes the only commonality between a buyer and a seller when the product is commoditized.³⁰ Price dependency for sellers and buyers often distinguishes commodity from a differentiated product. This may imply that managing price risk is far more important for commodities than it is for

12 Integration and forward contracting

differentiated products that are more likely to have supply chain back-to-back integration. However, merely differentiating products does not remove price risk, and any value added may actually increase the value at risk.

Whether product differentiation or perceptions of value adding actually results in a higher price may be very debatable and be specific to individual supply chains. If the differentiated product or added value merely meets buyer specification, then no price increase is likely to occur. Value to a seller might be quite different from a buyer's perspective. What may be perceived to enhance quality might merely result in better meeting product specifications at the same price. At best, there may be less price discounting because product specifications have been better satisfied, and perhaps less price volatility if there is an opportunity for supply chain integration.

Financial valuations, audits, and settlement of transactions must be performed at market prices in marked-to-market valuations. Immediate value is reflected in the spot market price, however, forward value is measured by the difference between the forward price and the prevailing spot market price adjusted for the time value of money. The possible eventuality of cash settlement in a forward contract needs to be reflected in daily valuation accounting for daily margin variations based on daily price movement.

Price is the essence of international trade because of the ability to arbitrage between low prices in one country and higher prices in another. Arbitrage cannot occur with bartering or countertrade because there are no price differentials. Also, it is the price of commodities such as crude oil which will determine freight costs and the profitability of arbitrage. High oil prices can diminish international trade opportunities and affect global food security. Prices in food deficit countries will need to rise to meet increased freight costs if imports are to occur.

Price may even determine discretionary costs for some producers.³¹ Farmers are likely to spend more on fertilizers at high output prices, and restrict such discretionary expenditure at low output prices. The final product with high prices may be completely different to a product at low prices, such as milling wheat compared to feed wheat. Expected output prices, discretionary expenditure, and product differentiation can be intricately linked.

The probability of a particular price occurring will have a huge impact on decision making regarding production, pricing, integration, and investment. Price affects the psychological behaviour of buyers and sellers in most aspects of business operations.³² Changes in risk attitude can occur with price movement.

Elasticity is a measure of the rigidity or flexibility of supply and demand caused by a change in quantity supplied or demanded given a relative change in price. The flexibility of supply will affect price and demand. Inelastic supply results in a small change in quantity supplied relative to a large change in price, whereas elastic supply has a large response in quantity supplied relative to a small change in price. Alternatively, inelastic demand results in a small change in quantity demanded relative to a large change in price, whereas elastic demand has a large response in quantity demanded relative to a small change in price.

Price reflects buyer and seller eagerness and market sentiment. In a deregulated supply chain, price is a momentary consensus between a singular buyer and seller.³³ No individual buyer and seller is required to know total supply and demand beforehand, or to calculate elasticities of supply and demand, for a price to be negotiated. The momentariness of price suggests that any permanency of market and price equilibrium is impossible because of dynamic variables associated with time.³⁴ Equilibrium may be an elusive goal for those who seek to control price.³⁵

Many countries still have their governments involved with major food and fibre purchases for defence personnel, hospitals, prisons, other government institutions, and frequently as 'buffer' or speculative stocks. Price can drive opportunistic speculative public tendering. If prices are low, public authorities can be encouraged to speculatively buy and hoard with public stocks. Alternatively, governments may buy when prices are rising because of public institutional catering panic or monetary inflation concerns.

Any major buying activity by government will impact domestic prices and private supply chains during both the accumulation and dumping phases, which seriously distorts price signals to farmers, merchants, and end users. The irony is that most government buying drives inflationary prices and increases the motivation to privately hoard in the expectation of even higher prices, both of which can decimate end users who have high investment risk in domestic supply chains.

Pricing considerations

Whereas price is integral to supply chains and markets, pricing is independent and can be accomplished through peripheral traders such as speculators. A speculator is anyone who takes a market position that is not offset. There does not have to be a physical trader for offsetting to occur, however there must be a buyer and a seller in a liquid market that has relevancy to the underlying supply chain in which pricing is occurring.

14 Integration and forward contracting

Pricing in the spot market can only be accomplished by immediately delivering or accepting delivery of the physical product. Forward pricing occurs in a forward market involving a need to buy or sell product at some price and time in the future.

Forward pricing is primarily undertaken to manage price risk, thus removing price variability from the profit equation. Removing one of the major variables in the supply chain enables management to focus on controlling other variables that are more difficult to manage such as supply and costs.

There are preharvest, at harvest, and postharvest implications with pricing. The paradox for many farmers is that it is psychologically easier to undertake pricing before harvest when there is product uncertainty than it is to undertake pricing after harvest when there is product certainty. Pricing through a physical sale after harvest can be such an emotional and difficult decision for many farmers that both pricing and selling responsibility is frequently passed onto a pool manager.

A simple supply contract excludes pricing, but price risk still remains for both the buyer and seller by being external to the supply agreement. Therefore, both the buyer and seller will have price risk in a supply contract until pricing is settled upon usually at delivery time.

Whereas pricing decisions usually cannot be isolated from the cost of production, discretionary cost expenditure decisions can be influenced by prevailing prices and pricing decisions.³⁶ Price, cost, and pricing are interconnected for some farmers in their decision making, but not for all farmers.

Management decision making on pricing is usually based on individual sentiments and psychological behaviour. Pricing usually depends on price and its movement, trend, and future expectations. Difficult objective analysis is frequently subsumed by easier subjective sentimental behaviour. This usually results in much regret over pricing decision making once hindsight knowledge is attained.

Factors preventing integration

Integration is often portrayed as being easy and dependent upon successful negotiation.³⁷ However, there has to be some initially perceived mutual benefit for buyers and sellers before integration is possible, regardless of the skills of negotiation. It is unlikely that any buyer or seller would deliberately integrate if it was disadvantageous for them. Whilst supply chains vary according to industry and product characteristics,³⁸ there are a number of very specific factors that can prevent mutual benefits and integration in food and fibre supply chains.

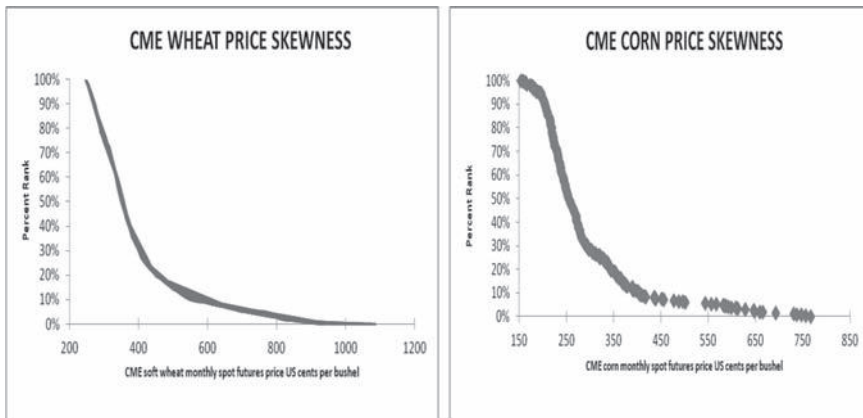


FIGURE 1.1 CME wheat and corn monthly price skewness: 1981–2012

Source: John Williams, 2013

Pearson identified positive skewness in many natural phenomena including commodity prices during the late 19th century.³⁹ Positive skewness results in low prices for commodities most of the time, with high prices occurring rather infrequently. Regardless of any naturally occurring phenomena, the positive skewness of agricultural commodity prices suggests that surpluses will depress prices most of the time.

Figure 1.1 compares the positive skewness using percent ranking for soft wheat and corn in an analysis of US monthly spot futures prices between 1981 and 2012. The results indicate that soft wheat experienced similar positive skewness to corn over this period.

Major positive skewness has important consequences in supply chain decision making for different market positions. It results in farmers experiencing low prices for most of the time. Farmers will struggle with profitability unless productivity and adequate cost control can outweigh the propensity for low prices. There is a need for occasional price volatility to provide pricing opportunities to enable profitability to occur.

It can be argued that positive price skewness is justification for income support and farm subsidies to counter the high probability of low profitability. However, the alternative is to allow normal price volatility to occur, on the understanding that the occasional price spike provides opportunities for farmers to retain profitability and to ensure the required on-farm investment occurs that secures future production and product supply. The corollary suggests that any policy of price control or suppression of price volatility will result in farmer poverty, on the assumption that there is no farm subsidy provision.

Positive skewness can result in farmers adopting more opportunistic behaviour in spot markets, and generally being reluctant to integrate into food and fibre supply chains in their pursuit of price and profit maximization. Some might perceive that such risk taking is required to remain viable, despite the propensity for prices to fall.

Such behaviour towards price speculation might be also justified by marginal farmers when there is high production and quality-grade uncertainty. The combination of positive price skewness with product uncertainty provides a disincentive to undertake forward contracting that locks in both price and delivery. Some perceive forward contracting to be introducing an opportunity cost at the same time as creating new risks such as delivery default.

One favourable attribute from positive skewness for a farmer occurs when hedging price, because of the propensity for prices to fall, which replaces the need for supply chain integration to manage price risk. However, such hedging does require some price volatility to occur to provide sufficient and regular pricing opportunities.

Supply chain integration and pricing decision making can be examined against trends in both price skewness and volatility over time. Such trend examination may indicate the propensity for farmers not to integrate with supply chains and adopt more speculative opportunistic behaviour.

Table 1.1 depicts the annualized price skewness and volatility from daily CME spot soft wheat and corn futures prices for the period 1983 to 2012.⁴⁰ Price volatility was measured by annualized standard deviation.

Farmers need regular occurrences of either negative skewness or price volatility to secure production and supply. The problem for wheat growers is that whereas during 1983–2002 there were five occurrences of negative skewness (1984, 1985, 1988, 2000, and 2001), there were no occurrences of negative skewness during 2003–2012. It might be argued that the increased price volatility in 2007 and 2008 was a response to the decline in negative skewness over the previous 25 years, which was followed by aftershocks in 2010 and 2012. However, the high prices occurred only temporarily, which suggests supply quickly overwhelmed demand through sales of privately hoarded product and government stocks, as well as the removal of export bans and increased new crop production.

This somewhat contrasts with corn that had 10 years with negative skewness between 1983–2002, but only 3 years with negative skewness between 2003–2012. The response from corn price volatility in 2007 and 2008 was muted compared to wheat, with relatively subdued aftershocks. Examining the end usage differences and trends between wheat (flour, feed, and starch) and corn (flour, feed, starch, syrup, alcohol, and ethanol) may explain why wheat is more positively skewed than corn.

TABLE 1.1 CME annualized wheat and corn price skewness and volatility: 1983–2012

<i>Year</i>	<i>Soft wheat</i>		<i>Corn</i>	
	<i>Price skewness</i>	<i>Standard deviation</i>	<i>Price skewness</i>	<i>Standard deviation</i>
1983	0.7411	19	−0.4404	32
1984	−0.2249	10	−0.0300	31
1985	−0.2394	23	−0.2751	22
1986	0.6593	25	−0.1938	34
1987	0.2431	16	−0.1312	14
1988	−0.0799	47	0.1233	46
1989	0.7058	17	0.0963	19
1990	0.2009	47	0.4721	21
1991	0.7026	41	−0.8996	8
1992	0.7464	43	0.0107	23
1993	0.1426	30	1.2454	24
1994	0.1346	30	0.3089	32
1995	0.1094	59	0.4037	37
1996	0.4701	64	0.1378	71
1997	0.6304	24	−0.1330	17
1998	0.3097	26	0.2383	24
1999	0.3216	13	−0.4456	10
2000	−0.1980	11	−0.2881	19
2001	−0.1037	10	−0.1934	10
2002	0.4177	48	0.4801	24
2003	0.3000	34	−0.6543	12
2004	0.2060	38	0.1448	43
2005	0.0232	16	0.9211	13
2006	0.7189	59	1.2845	52
2007	0.4181	173	0.1955	33
2008	0.1169	183	−0.0264	104
2009	0.2701	44	−0.1889	35
2010	0.2937	115	0.8219	88
2011	0.0911	80	0.0288	53
2012	0.0178	115	0.1243	74

Source: John Williams, 2013

Theoretical factors that might shift the mean (average) of the price distribution to the right include new product development, new end usages, consumer demand shifts, or perhaps decreases in transport costs such as shipping. From a farmer perspective, perhaps there is a need to discover more end usages for wheat to enable it to become less positively skewed.

A correlation may be established between decreasing negative skewness and increasing price volatility for both wheat and corn, but this does little to support supply chain integration. Unless there is a major and sustained increase in price volatility, end users may be reluctant to forward integrate when there are increasing pricing opportunities in the spot market. Pricing opportunities and profit maximization are strong motives by management to placate shareholders who may be wearied from persistent inadequate investment returns. Positive skewness can result in rewards outweighing the risks for most of the time, which then encourages opportunism.

Any attempt by end users to lock in forward prices through integration could result in competitors undermining them subsequently during prolonged periods of low prices. Maintaining competitiveness is therefore a major driver for input supply flexibility rather than legal obligation and inflexibility that derives from supply chain integration. Low prices predominate for end users under positive skewness, which creates only the occasional anxiety over high prices. The formation of commercial trade markets is very tenuous under such circumstances and may only be driven by the desire to procure specified product and to ensure quality controls.⁴¹

Whilst it may be uncertainty of product for end users, and uncertainty of price for farmers, which can drive supply chain integration via forward contracts, there are limits beyond which product uncertainty overwhelms the probability of successful integrative outcomes. The opportunity for price risk management therefore diminishes as the uncertainty associated with production marginality increases.

Variability associated with uncertain marginal production in Russia, Canada, Australia, and Argentina can explain why little supply chain integration occurs for many agricultural products in these countries. The uncertainty of weather and biological variation under dry-land farming may be minimized but not managed, unless irrigation is available. This can be contrasted to USA and Western Europe where greater farm product consistency and supply continuity drives and secures much supply chain integration, which can then be strengthened by product branding and promotion.

Ironically, it can be a small amount of uncertainty that creates disproportionately large risks in agricultural production which prevents supply chain integration.⁴² There needs to be much certainty in seasonal variation,

daylight hours, periodic rainfall, and photosynthesis for agricultural production to occur. However, the timing of a relatively small amount of rainfall can determine the success or failure of crop in terms of yield, quality, and product attributes. Uncertainty is a relative concept and cannot be generalized.

End users may avoid supply chain integration and price risk management under high product uncertainty and revert to opportunistic spot purchases, whilst marginal farmers may be more likely to avoid forward contracts prior to harvest because of delivery and transaction cost risk.⁴³ However, without forward contracts to provide supply chain integration, farmers can become isolated from the supply chain and output may become price-taking commodity.

Product availability drives spot market transactions for end users but only when there are product surpluses, whereas product shortages drive supply chain integration but the lack of product can cause supply chain disintegration. End users want integration during shortage periods, whereas farmers want integration during surplus periods. This makes integration mutually antagonistic and threatens the opportunism of both buyers and sellers. Therein lays the inherent contradiction for integration.

Therefore, supply chain integration and the development of commercial trade markets between end users and merchants paradoxically may only occur when there are product surpluses, which is opposite to what the end user probably wanted. It could be that integration is the second-best or even the third-best solution in strategy preferences for an end user.

Supply chain integration may be more likely to occur under mild production uncertainty, which is a mediocre compromise for buyers and sellers. Both farmers and end users need to perceive some uncertainty before integration may be seriously considered in preference to spot transaction opportunism. This has important consequences for countries that have certainty under price controls, where the only uncertainty lies in price manipulation. There may be little motivation to integrate under such circumstances, which may explain the amount of speculative opportunism that arises from government price controls.

Supply shortages can not only destroy commercial trade markets but damage everyone with contractual obligations associated with the product in the value chain. Supply chain integration usually does not exist in isolation. Commercial trade markets between merchants and end users usually extend forward to freight forwarders, wholesalers, and retailers in a 'circle of trades' through contractual commitments. Any disruption of product continuity and consistency can therefore affect the whole 'circle of trades'. Each contractual arrangement has to be unwound and cash settled at a

mutually agreed price. The associated transaction costs associated with contract default can be high, especially if low market liquidity results in wide bid and offer prices in the cash settlement period.

Under such circumstances, end users can either adopt spot market opportunistic behaviour or be forced into supply chain relationships with merchants who themselves may be forced into opportunistic spot market purchases, but over a wider region. It could be that other factors such as product continuity, specificity, traceability, identity preservation, and quality control drive supply chain integration with merchants more so than any great desire for commercial relationships and price risk management.

Supply chain integration is only made possible if end users are willing to invest in localities close to farmers. Integration is not possible without end users. Regional location of end users may occur where there are local supply surpluses for most of the time, which then leads to positive price skewness and much surety of supply. Alternatively, the benefits from positive price skewness must outweigh any disadvantages resulting from uncertain production and withholding supply, as well as the occasional price volatility. Unless there are perceived mutual benefits, supply chain integration is unlikely to occur between an end user and a farmer, or even a merchant.

End users may tolerate periodic shortages some of the time, provided that they can get product continuity and consistency most of the time. As vulnerability to operations increases, the end user is more likely to relocate to a more certain production locality, particularly when financial risks such as investment and debt are large. There is no government solution for optimum end user location other than to allow freer trade to occur. Pursuing domestic self sufficiency in production and manufacturing under high risk might incur too high a cost for consumers and economic growth.

Decision making regarding selling and pricing involves much emotional anxiety, regret and avoidance for many farmers.⁴⁴ If farmers have been previously disadvantaged in supply chain integration through contract default, cash settlement payouts, or legal proceedings, they will usually be reluctant to enter into legal contracts again, or at least until the memory of such events fade or become over-ridden by other selling calamities.

Marginal farmers would be expected to be the most affected by regret and avoidance attached to supply chain default because of weather and biological variation. The reality for most marginal farmers is that they are already speculating on production given some previous probability of product outcome. Their propensity for increased risk may be psychological consistent in an all or nothing approach, but their farming viability might be short-lived if risk exceeded certain limits. Any forward agreement to

commit to product delivery under such circumstances might be beyond the risk-taking willingness of many marginal farmers.

Organizational and logistical capability is required to deliver the exact quantity consistently, regularly and on time with cost efficiencies and meeting minimum hazard safety requirements. This requires adequate infrastructure, warehousing, transport, labour, and service facilities, particularly when just-in-time deliveries are required 24 hours a day, seven days a week.⁴⁵ These logistical essentials explain why most farmers are excluded from integrating directly with end users.

Farmer supply logistics is often reduced to waiting in a congested queue to unload into a public facility at harvest time. One alternative is to dump the product randomly at the door of an end user. However, end users need to avoid uncontrolled deliveries of deteriorating input supplies that have inadequate intake supervision, warehouse facilities, and quality management. This prevents integration with farmers and forces most end users to out-source accumulation functions to merchants who are prepared to take the risk of financing, warehousing and delivering the product to the end user just in time.⁴⁶

Bulk handlers and up-country elevators are generally focused on commodity volume-cost efficiencies through economies of scale. In contrast, integrative merchants must delicately balance the needs of cost efficiencies with meeting the end user logistics specifications with operational consistency, whilst minimizing risk and maximizing margins.

Weaknesses in management response behaviour can result in regular over ordering and surplus inventories whenever demand changes.⁴⁷ The greater the number of intermediary stages, particularly along fibre and clothing supply chains, the greater can be the over-ordering response and huge inventory stockpiles can result, which takes years to diminish.⁴⁸

Surplus inventory can damage supply chain integrative relationships just as much as product shortages. Buyers are forced to stand-down suppliers for lengthy periods of time until inventories fall. Relationship trust often disintegrates into opportunism, while acreages planted, or the number of sheep in the case of wool, become jeopardized because of the resultant price collapse.

Supply chain integration and commercial trade markets are unlikely to occur when the product is not sufficiently differentiated for niche buyers or when there are many product substitutes.⁴⁹ Buyer disinterest is likely to lead to commoditization, which may appeal to both farmers and bulk handlers through some cost savings in economics of scale, but this does little to integrate farmers into supply chains and make themselves more relevant.⁵⁰

22 Integration and forward contracting

Given the increasing infrequency of negative skewness and price volatility in Table 1.1, as well as the marginality of production and occurrence of price controls in many countries, it might be concluded that food and fibre supply chain integration may be the exception rather than the norm for many agricultural products. This can cause a huge disjoint between what farmers are wanting to produce and what consumers are willing to buy, with little feedback from distant merchants or international end users as to what is required, and when or where. It can result in increasing the commoditization of food and fibre industries, as well as worsening the dependency on price as price takers. Ironically, it can be price certainty and interventionist control which are the antitheses of cluster industry and food hub development.

Contracting and contract law

Forward contracts are the foundation of supply chain integration. Unless there is vertical ownership, supply chain integration invariably involves one or more forward contractual commitments between buyers and sellers, usually in a circle of trades.⁵¹ The buyer and seller become obligated to each other for the duration of the agreement under contract law and this requires astute management.⁵² Without such contract laws supporting supply chain integration, there can be no forward markets and no price risk offsetting mechanisms, which explains why managing supply chain risks is limited to those few countries that enforce contract law.

Forward contracting implies a time limit on commitment and trust, which is contrary to the ideals of permanent integration. This time limit reflects the general fickleness of consumer preferences and the uncertainty of agricultural production and quality. Continual change prevents any permanency in food and fibre supply chains, which then creates its own uncertainty and risk. From an investor perspective, contracting may add to investment security, however the short duration may detract from investor confidence.

Whilst a contract is any verbal, written, or electronic agreement between two parties, such seeming simplicity is confounded by the increasing complexity of contract dispute precedents. Contract law establishes four distinct phases to a physical forward contract. There is a passive offer to buy or sell. Then the other party must agree to match the offer. This offer matching process still does not constitute a forward contract because the terms and conditions of forward exchange have not been agreed upon. One or both parties need to provide the terms and conditions for the forward exchange. It is only when all terms and conditions have been agreed upon by both

parties, either verbally or in writing, does a forward contract come into existence. There may be a cooling off period, but this needs to be stated in the terms and conditions.

It is usual for the conditions to state the product specifications, quantity, quality, price, delivery and settlement dates, payment or credit terms, and dispute and arbitration terms. The forward transaction needs to be specifically defined in terms of contract conditions.⁵³ Both parties need to expressly agree to all such stated terms and conditions, usually in writing, before a valid forward contract is established.

Silence cannot be construed as acceptance of the contract, and any price or offer will only be for a limited time.⁵⁴ Any acceptance of the offer must be made within the stated time, or a 'reasonable' time lapse if there is no stated time, otherwise the offer can be revoked. A forward contract is also confined to the time limits of the ultimate physical transaction, with both parties requiring agreement before contractual time limits can be altered or extended.

There is a huge difference between an agreement for a spot transaction where there is immediacy of delivery, payment, and known conditions, and a forward agreement for a transaction at some future time under uncertain and changed conditions.⁵⁵ It is the time element that makes the terms and conditions of any forward agreement so important and the outcome so unpredictable.

Contract law and its complexities has had its origins lost in the eons of time.⁵⁶ The ancient Sumerians recorded their transactional law in cylindrical clay imprints, whereas the Babylonians recorded their Hammu-Rabi contract laws and codes on basalt stelae.⁵⁷ Forward contracts were never going to be simple agreements.

Time is the real culprit to many of the problems involved with contract law. Circumstances can change, events can subsequently occur, while human psychology and behaviour continually shift. What was wanted yesterday is not wanted today. What was agreed upon today is reinterpreted differently tomorrow when other facts are known. What was thought would happen did not happen.

If there are general problems with contract law, then they are intensified in food and fibre supply chains because of the uncertainty of production.⁵⁸ Product is both the essence and curse of agricultural contract law because of the periodic failure of production. Alternate supply chains generally have the advantages of product certainty, whereas biologically dependent agricultural products do not.⁵⁹ One consequence is a wide variation of different agricultural forward contract types.⁶⁰

24 Integration and forward contracting

Failure of production could occur through force majeure such as losses caused by a third party, or, more frequently, through an act of god, such as losses caused by non-human activity such as weather. Although these are both beyond the control of either party to the contractual agreement, the terms and conditions of the original contract become paramount in any settlement. However, interpreting the terms and conditions can vary and lead to dispute.

If product is the essence of an agricultural contract, then one alternative is an acreage or hectare contract which takes quantity out of the contractual commitment. The farmer delivers and the merchant accepts whatever is produced on the prescribed acreage, but within the terms and conditions of the agreement. However, this shifts product risk from the seller to the merchant. Unknown production and delivery jeopardizes physical forward sale commitments for the merchant, whilst any price 'hedge' might be mere speculation with financial losses not being offset. If prices rise, actual deliveries against the contract often fall short of expected production. Alternatively, if prices fall, actual deliveries against the contract may be more than expected production.

Another variation to agricultural forward contracts to overcome product differences is for a merchant to offer a barème of prices in a premium-discount schedule within a multigrade contract. The prerequisite for such merchants is to have diversity in end user categories and many potential commercial trade markets. However, these contracts are still focused on production, with contractual obligations and high delivery risk for marginal farmers. Again there is an inability of the merchant to forward sell because of unknown product grade, however there is more surety to externally manage price risk through hedging strategies.

If market position for a farmer commences as soon as the first expenditure occurs for fuel, seed, fertilizer, and chemicals, then it can be argued that unless the downside price risk was protected, the farmer would be speculating on price. However, if the production risk was sufficiently high, then it can be equally argued that by replacing price risk with production and delivery risk in a forward contract, the subsequent financial outcome might be devastating to the farmer, especially if prices rise when there is a production shortfall, and a large cash-out payment is required for settlement.

The motivation to forward contract by dry-land farmers is often driven by pricing opportunities rather than production probabilities. Instead of separating the physical product from alternate pricing strategies prior to harvest, they jeopardize their business operations by combining the anticipation of physical product with pricing in a forward contract. The alternative

is for farmers to manage the anticipated price exposure quite independently of the physical product, through the usage of price hedging strategies.

The role of government

There are many important roles for government regarding agricultural supply chain integration that do not involve direct intervention. These include ensuring sufficient competition and minimizing monopoly and collusive practices, enforcing contract law, providing defence against acts of aggression, ensuring the stability of government, privatizing factors of production such as land and resources, minimizing corruption, deregulating markets including labour, finance, currency, and capital investment, and minimizing inflation and taxes through adequate monetary and fiscal policies.⁶¹ Governments are also required to counteract and resist the forces for re-regulation once the initial deregulatory processes have begun. Without such government functioning, the resulting private supply chain power, corruption, and uncertainty can prevent normal supply chain integration, commercial trade market development, and the formation of forward markets that are so vital in risk management.

The provisioning and catering requirements of public institutions such as defence forces, hospitals, and prisons represent the biggest buyers of food and fibre products in many countries, especially when government tenders extend to general public procurement. There is a need to minimize negative impact and ensure efficiency in public procurement to avoid crowding out private supply chain initiative, investment, and integration.⁶²

Governments that encroach on private supply chains can easily distort price signals that are essential for decision making based on efficiency criteria. There are limits to government regulation, beyond which the security of food supply chains is jeopardized by disintegration.⁶³ Regulatory balance requires good governance and economic reform leadership.⁶⁴

2

FORWARD MARKETS

The formation of effective and liquid agricultural forward markets has eluded most countries and futures exchanges.¹ Forward markets do not simply occur once deregulation has been achieved, and they do not automatically evolve if liquid spot markets have been established.

Whilst it may be easy to establish forward markets for financial products based on forward interest rates and the time value of money, there are some very unique features about forward markets for commodities and agricultural storable products in particular. From a historical perspective, it took 40 years for Chicago to develop a liquid forward market, yet it had many positive contributing factors.

Development of the Chicago forward market

Prior to 1830, Chicago was only known by the establishment of Fort Dearborn in 1803 and farm expansion to the south through an increasing network of roads.² Commercial vessels finally arrived in 1834, which transported agricultural products from Chicago through the Erie Canal and down the Hudson River to New York. Chicago did not have any natural comparative advantage in trade, particularly when compared to New York, New Orleans, and ports along the Mississippi River.

The commercial trade of Chicago developed when a canal linked Lake Michigan to the Mississippi River in 1847.³ Products from Canada and the

Great Lakes then flowed south through Chicago and on to New Orleans via the barge trade, which then turned Chicago into a vibrant agricultural trading hub.

New York inevitably felt threatened by this north-south trade flow, especially when the French Government undertook grain transactions in Chicago and New Orleans rather than in New York as early as 1855. The battle lines were drawn between the north-south free trade verses the protectionism and centralism of the north-east. Chicago was to be the pivotal prize in the war that began in 1861 which established the future direction of US trade.

Chicago was up-country and isolated before 1847 due to poor communications, but this changed with the completion of the telegraph line from New York. This telegraph was soon to be extended to London via the Trans-Atlantic underwater cable in 1866. However, whilst the trade hub and improved communications assisted the development of a Chicago agricultural spot market, they did not make much contribution to the development of a forward market.

It was the rapid increase in food manufacturing after improvements in food canning mechanization occurred after 1846 which increased the need for a forward wheat and corn market in Chicago. Cluster industries and end users proliferated around Chicago before and especially during the Civil War, which led to the need for merchants to accumulate and store grain and then deliver it at some future time. However, merely storing at a cost and delivering grain at a future time did not establish a forward market. What challenged Chicago for four decades was that there was no warehouse market mechanism that adequately linked commercial inventory space with the storage charge.

The Union victory in the Civil War promoted east-west rail links from New York to Chicago by 1883, which were extended westward to Seattle, thus opening up the Midwest to the Pacific trade and East Asia.⁴ Local railway lines then spread out from Chicago through the Midwest and into Kansas, thus turning Chicago into the railway capital of the USA, which was in addition to being a barge transportation hub. Critical volume throughput had finally been achieved for substantial market development.

The rail link to New York ensured that the new-crop midwest wheat could be delivered via clipper ships into Europe before the main European grain harvest and achieve new crop premium prices.⁵ These early season wheat imports devastated prices for European farmers, and subsequent displaced farm labourers sought mass migrations from northern Europe, ironically to cities such as New York and Chicago.

Supply chain integration using corn forward contracts between local commercial trade buyers and sellers in Chicago was first recorded in 1851.⁶ The standardization of aligning volume bushels and bags into actual imperial weights in 1854 was important in establishing weight valuations and price increments in a centralized market. A large commercial warehouse was erected in Chicago with a 270,000 tonne capacity in 1864. These events together with the ending of the Civil War led to the introduction in 1865 of standardized, tradeable, and transferable forward contracts, which are otherwise known as futures contracts, whose performance bonds through initial margins as well as daily margin settlements were facilitated through an exchange clearing facility.

Chicago took 17 years, from 1848 to 1865, to progress from a sufficiently liquid spot market to the development of a centralized exchange and futures contracts, yet a liquid forward market was still elusive.⁷ It was not until the 1890s that some liquidity was achieved in forward grain markets.⁸ Chicago therefore took 40 years to have a forward storage cost-carry fluctuating with the size of warehouse inventory and available storage space, which is so critical in the development of an efficient forward market pricing mechanism.⁹ Paradoxically, it took another 40 years before economists began to have an elementary understanding of this forward price mechanism.¹⁰

Benefits of a forward market

Forward transactions create time value at today's price, which creates orderly conduct for negotiations in forward commercial trade markets. However, time value and orderly conduct only occur with storable products under surplus conditions. Disintegration of orderly forward markets occurs whenever product shortages occur. It is impossible to have an effective forward market for perishable products or when product shortages occur.

Understanding the benefits of a forward market invariably leads to an appreciation of the difficulty in establishing them and just how fragile they are. It explains why most global food and fibre supply chains have some dependency on the prices established in the forward markets of Chicago and New York.

Without a forward market, it is unlikely that the management of forward price risk could occur. Risk management invariably requires a forward market because of forward linking and transactional agreements between buyers and sellers. Without a liquid forward market, willing forward buyers are unlikely to be equally matched with willing forward sellers at an agreed forward price and time duration.

Although the forward market must be structured upon the spot price for storable products through the storage cost, an effective forward market can reinforce the liquidity of the spot market. There can be more transparency and confidence in the spot market when a forward market exists.

Although market depth is the number of bids and offers at various prices above and below the current market price, it can have time duration and vertical dimensions in a forward market. Wherever accurate forward price signals can be clearly transmitted in an efficient supply chain and a forward market developed, this can increase market depth by the number of forward months offered for contracting and vertically by the liquidity in each month. US wheat markets may extend for two to three years and be tempered by forward supply chain biological production risk and change in consumer preference. Vertical depth may depend on price volatility, expectation of forward price movement, and speculator or spread trader sentiment.

In contrast, supply chains that are totally dependent on spot transactions transmit very few price signals for forward decision making, and generally have low volume transaction and market depth. Such spot transactions are likely to be made privately without benchmarking transparency.

An efficient forward market provides price signals as to the profitability of storing product in surplus commercial trade markets. Based on forward warehouse cost signals, merchants will be more likely to warehouse storable product for end users when forward prices reflect storage costs, and reject warehousing of product when forward prices do not reflect storage costs.¹¹

Forward markets have far more benefit to those involved with product specificity. Flour millers would be far more likely to integrate with merchants in a forward market, because of the need for specific product, compared to feed buyers who are more focused on least-cost product substitutable spot purchases that can be achieved directly through farmers. As input product attributes become more specific to meet technical milling equipment requirements and output product specifications, end users are extremely unlikely to contract directly with farmers who have biological variability and delivery uncertainty. The corn forward market is much more likely to be 'dependent' on its food, ethanol, syrup, and alcohol attributes, compared to its starch or feed usages.

Price signals between merchants and end users in commercial trade markets can act as benchmarks for forward transactions between merchants and farmers. A liquid effective forward market guides decision making regarding buying, selling, and pricing for all supply chain participants, particularly when it becomes transparent through a forward futures market. Without

such forward price discovery in a commercial trade market, all other forward prices would be very speculative and difficult to negotiate.

A concentrated hub of local commercial trade markets with many forward transactions is more likely to develop into a transparent futures market with a clearing house mechanism for settlement procedures. A relevant liquid futures market is more likely to be used for benchmarking and risk management by other national and international supply chain participants, which further increases liquidity. Alternatively, a futures market that has little relevance to underlying commercial forward trade transaction prices can become manipulated by speculators and generally lose liquidity because of a lack of forward trust and confidence, and a decreased ability to offset risk for hedgers.

Food insecurity is most likely to occur when there is a lack of orderly forward markets that reflect ineffective local commercial trade and warehouse markets.¹² Commercial inventory in the absence of forward markets is likely to be replaced by hoarded speculative commodities either privately or by government. Supply chain integration is replaced by spasmodic transactions and opportunistic behaviour, with periodic shortages being inadvertently encouraged.

The functions of price

Flexible and multiple pricing in deregulated supply chains reflect great diversity of output and the dynamism of supply chains. Efficient price signalling and a regular occurrence of correct decisions are likely to encourage risk taking investment, which is the key to domestic cluster industry development.¹³ A flexible price that is derived from competitive practices and efficient supply chains has many functions, particularly as a guide to decision making.

Price has some important preharvest functions.¹⁴ An efficient price mechanism is a substitute for information, with farmers increasing or decreasing their new crop acreage based on adequate price signals. However, whether a high price actually results in higher acreages depends on relativities to other agricultural prices, agronomic rotational issues, subsidy distortions, trade policies, counter-cyclical decision making, and the vagaries of weather. Low prices may result in increased acreages in an attempt to maintain farm income and cash flow.

Preharvest decisions impact postharvest outcomes, prices, and subsequent decision making.¹⁵ Postharvest prices can signal the availability of supply and location of needs, as well as differentials based on grade, type,

quality, and lot size. Low prices can encourage buyers to buy and consumers to consume more, whereas high prices can discourage buying.

Price is the essence of a forward market. The movement of spot price relative to a forward price and between forward month prices should provide important signals to farmers, merchants, and end users as to what is likely to occur in the near future.¹⁶ Price can provide signals as well, by discriminating with premiums and discounts between old and new crop.

Prerequisites for a forward market

Despite Chicago being up-country and not internationally port-based, its uniqueness lay in its ability to overcome difficult geographic locality and comparative advantage constraints.¹⁷ Some might argue that it took a civil war to achieve this, while others might debate that the rise and pre-dominance of Chicago occurred despite trade protectionism and industry support programs. There are a number of factors why Chicago succeeded in developing an effective forward market.

The pre-US Civil War period that was characterized by a minimalist government approach,¹⁸ market innovation,¹⁹ and supply chain efficiencies contrasted sharply with the post-Civil War era of centralized government, increasing monopolies, nonvoluntary cooperatives, and anticompetitive behaviour.²⁰ Subsequent regulation of many global agricultural supply chains has either impeded or prevented forward markets and their development. Effective forward markets cannot be established when monopolies or oligopolies can fix prices or determine noncompetitive warehouse costs.²¹

Competition and contestable practices can result in greater transactional volume in commercial trade markets²² and assist the development of forward markets. Competing commercial trade markets and competition both within and between supply chains are usually required for efficient price signalling. Governments are required to enforce competition, remove monopoly practices, and ensure that reregulation does not impinge on supply chain efficiency.²³

Wrong or misleading price signals through price controls can cause serious errors in buying, selling, storing, production, and manufacturing decisions, which can then distort the forward market and ultimately destroy it through speculation.²⁴ In contrast, forward market liquidity, underlying commercial trade market transactions, and cluster industry activity are likely to be enhanced whenever and wherever there are clear transparent price signals.²⁵

Given the experience of Chicago, hubs of agricultural buying and selling activity are more likely to form strong spot market activity and liquid forward markets.²⁶ However, there needs to be a critical, concentrated minimum volume to support the formation of an adequate commercial physical forward market that can lead to a liquid forward futures market.

Winnipeg has some east-west and north-south trade, but it competes with Thunder Bay, Vancouver, and cross-border transactions, especially at Duluth and Minneapolis. Diverse geographies and commercial trade dispersions may also explain why Paris, Frankfurt, and London struggle with agricultural trading volumes when compared to Chicago. The geographic fragmentation of agricultural markets in Australia and Brazil results in only periodic shipping activity at each decentralized port. If there is no regularity of commercial spot trading, it is highly unlikely that forward market development can occur.

One solution for spasmodic port trade for sugar and coffee is to base spot and forward price discovery on multiple international trading ports and their warehouse costs, either for export (sugar) or import (coffee) prices. This international multiple port combination for delivery and pricing generally has created success in the underlying commercial supply chain and driven efficiency and liquidity in both the spot and forward futures markets. However, there has to be some product homogeneity between the ports to facilitate this. Highly different wheat varieties and grades within regions and between ports can decrease the effectiveness of singular futures markets and undermine multiple port futures market functionality.

Surplus agricultural forward markets are derived from storable products and their warehouse carry costs.²⁷ Forward markets cannot be based on perishable products that have no forward time value under storage conditions. If buyers do not value the storage of products, there can be no physical forward market, and any attempt with such a forward futures market is likely to be illiquid or highly speculative. It is possible for a futures exchange to be a forward market maker,²⁸ but this is likely to be based on speculation of agricultural variables such as weather predictions and future supply and demand expectations.

End users must perceive forward value for each input supplied at a future time. This requires specific product accumulation and segregated warehousing. End users are pivotal to forward market development because forward prices must reflect the value perceived by end users. Many commingled products do not have end user value due to manufacturing equipment malfunction and consumer nonpreferences.

Any warehouse storages that do not clearly separate commercially owned inventory from unsold commodity cannot have an efficient forward market whereby commercial inventory storage costs are made dependent on external warehouse space availability. Therefore, commoditization through commingling in bulk warehousing is highly unlikely to support an effective forward market.

Whilst there could be adequate roads, railways, ports, warehousing, and up-country elevators and storage facilities, these may not induce a forward market. Sophisticated railway networks from up-country to port may have assisted commoditized exports in both Canada and Australia, but they did little to encourage domestic end usage and cluster industries, or the development of an effective forward market.

Food and fibre cannot be compared to mineral commodity exports that can achieve substantial economies of scale efficiencies through rail-port centricities. Infrastructure for food and fibre industries must facilitate segregated product and specialist supply chain development before a forward market can be developed. The irony is that much private domestic end user investment is discouraged because of local product supply insecurity that is exacerbated by import bans when domestic shortages occur. Inadequate end user investment combined with locality supply uncertainty is not conducive to the formation of liquid forward markets.

An efficient forward market requires price signals that link private commercial product inventory to warehouse space availability. An efficient warehouse market should transmit commercial warehouse space availability through its carry charge. As commercial inventory increases, the carry charge should increase because of decreased warehouse space. Alternatively, as commercial inventory decreases, the carry charge should decrease because of increased warehouse space.

There cannot be an efficient forward market when commercial inventory warehousing cannot be segregated from speculatively stored product that is owned by farmers or merchants. Also, the problem of varying carry with warehouse space is increasingly being compounded for grain and oilseeds by huge variations in warehouse design and new bunkering technology that shifts simple elevator design away from the traditional confines of concrete, bricks, and mortar. This creates difficulties in actually defining a commercial warehouse market, particularly in countries where such storages are very geographically decentralized. Confining noncommercial speculative storage to bunkers might offer one solution, but the problem of critical volume of centralized warehoused product remains. The success of forward markets

for grains and oilseeds at Chicago during the nineteenth century may have been an anomaly in history that is nonrepeatable.

One of the success factors in US forward market development has been the national standardization of new crop years and the commencement of new crop warehouse carry charges. Forward US wheat prices are focused on the standardized application of a carry charge per month commencing on the first of June each year. Contrast this to Australia which has a national standard starting date of new crop wheat of the first of October, but the actual commencement of carry varies with region and latitude as harvesting progresses from north to south.

Differentiating between carry and contango

A contango is a payment made by an end user to a merchant to defer the delivery of specified product to a later date. Whilst the exact components of a contango are established by private negotiation and are not publicly disclosed, carry is usually one component of a contango. Carry refers to the monthly cost of warehousing inventory for product accumulated by the merchant for the end user. The agreement to provide a contango is usually the foundation of a commercial trade market under surplus product conditions.²⁹ Carry does not voluntarily apply to any unsold or noncommercial product that might be speculatively stored by farmers, merchants, co-operatives, private commodity pool operators, or statutory authorities.

If a merchant owns the product and warehouse, then a carry cost per month should include all costs associated with the time differential. These include product shrinkage, the opportunity cost of money, quality control, and maintenance charges including administration and insurance. Carry does not include costs associated with intake and out-take. Accumulated product inventory being warehoused for the commercial trade market is a back-to-back transaction with no potential for losses due to price and currency movement.

Alternatively, if a merchant rents warehouse space, then the perspective of carry can change. Carry may become a flexible rental charge, which can vary according to the demand for warehouse space. Decreasing warehouse space should increase the monthly carry charge, whereas increasing warehouse space should decrease the monthly carry charge. However, the carry charge under rental conditions depends on the terms and conditions of the rental agreement.

If warehousing is monopolized, carry usually becomes fixed. Domestic merchants and commercial trade markets may co-exist with a monopoly

warehouser, however storage costs may reflect marginal cost plus monopoly profit and have no response to the quantity of commercial inventories being warehoused. The size of government public catering and the need for associated warehousing space further complicates the development of a forward market.³⁰ An efficient liquid forward market with forward carry signals reflecting forward inventories is unlikely whenever competition in supply chains and warehousing is restricted.

Warehousers, end users, and domestic merchants must bear some responsibility for clarifying forward carry signals so that a forward market can be developed.³¹ An efficient forward market mechanism should have an orderly structure of forward prices under surplus supply chain inventory conditions, reflecting the cost of carry per month for the immediate old crop and some projection for new crop.³² This orderly market structure results in a stepped price formation in the forward market, regardless of daily spot price movement. If the spot price increases, the stepped price formation in the forward market is generally continued. Alternatively, if the spot price decreases, the stepped price formation in the forward market usually is consolidated. Carry in a surplus contango forward market is depicted in Figure 2.1.

Carry in the forward months is rather meaningless unless the old crop and new crop months are distinguished (Table 2.1). Actual carry should apply to old crop inventories only.³³ New crop carry is based on projected new crop production estimates that are dependent on speculative weather sentiment and hoarder decision expectations.³⁴ Any month beyond the new crop is highly speculative with frequent illiquidity.

Because carry in Table 2.1 is relatively stable in the nearby forward months, forecasting any price trend based on carry movement is difficult

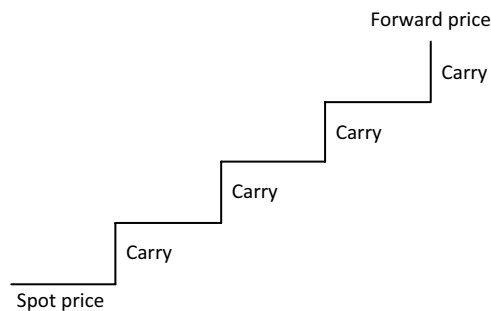


FIGURE 2.1 Monthly carry in a surplus contango forward market

TABLE 2.1 Carry and forward market sentiment

<i>Month</i>	<i>Price</i>	<i>Possible forward market interpretation</i>
December	785	Relatively constant carry per month exists in a contango old crop market.
March	800	
May	810	
July	820	Decreasing carry per month is projected into the new crop year.
September	830	
December	845	
March	855	
May	860	This is speculating that carry per month will continue to decline and be ultimately removed.
July	870	
September	875	
December	875	
March	870	

Note: Gap between May and July indicates new crop year.

unless carry is studied over time.³⁵ If carry between two particular near months is consistently increasing in a contango forward market, this is likely to express bearish sentiment because of the greater surpluses leading to decreasing warehouse space. This would occur if hoarders started to sell old crop, or new crop production was higher than previously estimated.

Alternatively, if carry between two particular near months is decreasing in a contango forward market, this is likely to express bullish sentiment because of lesser surpluses leading to increasing warehouse space. This would occur if hoarders increasingly deferred sales of old crop, or new crop production was lower than previously estimated.

Speculation occurs in distant month prices because of the uncertainty over both production and supply.³⁶ Acreage, weather, and hoarding sentiment can change the forward month structure quickly.³⁷ However, as distant month prices approach near month prices over time, more certainty is factored into the forward price.³⁸ What was previously highly speculative can become more predictive in terms of harvesting and hoarder sentiment.³⁹

Both the contango market and carry payment cease to exist when product shortages occur and end users want immediate spot deliveries.⁴⁰ End users do not want deferred deliveries when product shortages occur.⁴¹ Therefore, contango and carry situations are entirely dependent on the availability of surplus product, which is indicative of bearish conditions.⁴²

Carry and its inability to forecast

The current spot price should reflect the current expectation of the future spot price.⁴³ When forward prices are based on spot price plus carry in surplus inventory contango conditions, the forward price movement reflects spot price movement plus carry movement.⁴⁴

Whereas forward prices reflect today's spot price and today's forward carry, they cannot predict tomorrow's spot price and tomorrow's forward carry unless a trend is established.⁴⁵ Attempting to forecast price and carry based on quantitative modelling is bound to fail because the underlying spot and forward pricing mechanism was never designed to forecast for future events.⁴⁶ If they were predictive, there would be no markets because of similar sentiment and lack of transactions.

Spot and forward markets do not fail when they lack predictive power,⁴⁷ because price and markets are based on uncertainty.⁴⁸ It can be argued that an unlikely combination of certainty and human existence would lead to bartered transactions without any need for prices and markets.

However, trend movement of carry in an efficient forward market can provide signals, which some might equate to forecasting.⁴⁹ On the assumption that carry movement somewhat reflects commercial inventory in the physical trade market and is not due to the pressures of speculative spread traders, then carry movement over time might indicate changes in immediate old inventories and new crop expectations.⁵⁰ A consistent trend of decrease in carry could indicate increasing bullish sentiment, whereas a consistent trend of increase in carry could indicate increasing bearish sentiment.

Any positive price differential beyond the new crop is speculating on planting, harvesting, and weather conditions, as well as hoarding sentiment.⁵¹ Forward month pricing beyond the immediate new crop for a storable product approaches that of a perishable nonstorable product because it is nonexistent.⁵²

Backwardation in shortage supply chains

The weakest link in food or fibre supply chains is the biological origin of the product. Drought, tempests, pests, and diseases can cause production losses that can trigger supply retention and collapse in commercial trade markets due to product shortages.⁵³ Periodic artificial shortages can exist in an abundant world, as evidenced by the positive skewness of agricultural prices.

An end user will respond to increasing shortage conditions by being reluctant to pay a contango to merchants.⁵⁴ The first sign of real trouble

could come when the merchant warns the end user that a supply contract default is possible because of an inability to accumulate sufficient product. There may be suitable product in existence, but the supply availability of this product can be restricted either because of private hoarding, reluctance of commodity pool managers to sell, or government acquisition for publicly hoarded stocks.⁵⁵

Private or government hoarding can increase under production uncertainty in producing countries such as Russia, India, Pakistan, China, Thailand, Vietnam, and Australia, especially when import barriers reinforce the impact of hoarding.⁵⁶ Importing governments then tend to overreact with their purchases, particularly when producing countries impose export bans.⁵⁷

As an example, the Russian Government acquired 6 million tonnes of domestic wheat in August 2010, thus exacerbating a mild shortage into a high-priced real shortage that impacted Russian end users in the accumulation phase and devastated Russian farmers in the off-loading phase in July 2011, just in front of their new crop harvest prices. Import-tender governments in the Middle East and North Africa overreacted to the Russian wheat export bans with excessive buying in late 2010 because of the threat of public and institutional catering panic. High bread prices contributed to the Spring Uprising in early 2011 throughout the Middle East and North Africa, and Russian election riots in early 2012 may have had some origin from the Russian Government debacle. Russia subsequently joined the World Trade Organization in the aftermath in August 2012.

When product supply uncertainty increases, the more prudent merchants will not renew supply chain contracts with end users because of the high probability of delivery default. Potential product shortages might induce the end user to substitute alternate ingredients, or refocus on alternate products as Kraft did in the USA in response to the higher wheat prices in August 2010. However, some end users panic under the threat of operational stand-downs and offer a spot price premium to attract immediate product supply and delivery.⁵⁸

This spot premium, otherwise known as a backwardation, is a payment by the end user to attract immediate product supply and delivery under shortage conditions.⁵⁹ It causes the forward market to become inverted, with the spot month price being at a premium to the distant month prices, or the distant month prices being at a discount to the spot month price.⁶⁰ Some might argue that this discount is due to the 'inconvenience' of deferring delivery.⁶¹

The backwardation can be paid by an end user to either a farmer or a merchant to attract sales, and it is likely to be paid outside of any commercial trade agreement in desperate management behaviour. Urgency of product delivery is of the essence, particularly when imports are denied to the supply chain, and especially when suitable product is being hoarded privately or in government warehouses.⁶²

If backwardation is consistently increasing in an inverse forward market between two particular nearby months, this is likely to express bullish sentiment because end users are increasing the spot price premium to attract immediate supplies. Alternatively, if backwardation is consistently decreasing in an inverted forward market between two particular nearby months, this is likely to express bearish sentiment because end users are unwilling to increase the spot price premium to attract immediate supplies.

Table 2.2 indicates spot price inversion and forward market backwardation that signals immediate product shortages associated with old crop. There may be expectations of new crop supply, but until harvesting is completed, any new crop estimations must remain speculative. Any forward price backwardation beyond the new crop harvest is based entirely on speculation that adverse weather and hoarding will continue.

Theory suggests that backwardation should apply just to the immediate nearby months whenever shortages occur, because end users only pay

TABLE 2.2 Backwardation in the forward market

<i>Month</i>	<i>Price</i>	<i>Possible forward market interpretation</i>
December	780	Old crop backwardation with end users paying a premium for spot sales and discounts for deferred sales.
March	770	
May	765	
July	760	New crop backwardation continuing in the expectation of future product shortages.
September	655	
December	650	
March	640	
May	635	Speculation that future production will overcome shortages and that carry will be required to store surpluses.
July	640	
September	645	
December	645	
March	650	

Note: Gap between May and July indicates new crop year.

a spot premium for immediate delivery. However, the reality can be quite different.⁶³ Backwardation can begin speculatively in the far distant forward months because of forecasted future product shortages, and gradually move closer to the spot month over time if actual shortages become realized. Alternatively, any backwardation would be expected to move further out into the distant months with increased acreages and favourable weather conditions.

Whereas carry might be considered orderly whenever adequate inventory occurs in commercial trade markets, there is nothing orderly about the size or movement of backwardation.⁶⁴ Nearby months under backwardation are controlled by desperate buyers attempting to outwit hoarders, whilst distant forward month pricing can be very speculative and disorderly.⁶⁵

Stages of backwardation

On the assumptions that backwardation commences with product shortages in the near months, that the supply chain and warehouse market are providing efficient signalling, and that there is warehouse segregation of commercial inventory from unsold commodity storage, there are six possible stages in backwardation.

The first stage of backwardation occurs in the warehouse market with decreasing carry charges, which indicates more warehouse space availability and less demand for such space. This is indicative of decreasing old crop product supply. Product might be stored elsewhere under hoarding, but the commercial trade inventory in warehouses is declining. This first stage may or may not lead to inversion in forward market prices, as much depends on the availability of new crop product.

Whenever carry continues to decrease, and old crop commercial inventory continues to decline, as reflected through the increased warehouse space, backwardation eventually appears somewhere in the forward months, either in the old crop, the new crop, or in some distant year. This is the second phase of the backwardation process. Expectations of increased product shortage will gradually shift the backwardation from the more distant months to the near months.

End user response to expected product unavailability usually leads to higher spot prices due to the offering of a price premium by the end user. This backwardation causes the spot month price to rise sharply relative to the distant month prices and represents the third phase of backwardation. One alternative, although the result is the same, is for the end user to offer a discounted price for any deferred deliveries.

The fourth phase of backwardation occurs outside of existing commercial trade markets and applies to many opportunistic merchants who have accumulated stocks in anticipation of sale agreements to end users. They expected reimbursement of carry but now discover that end users are actually offering discounted forward prices. This might be referred to as the accountancy phase. An operations auditor might question why the merchant is storing product when there is no reimbursement being offered by end users.

This results in any unsold stocks being sold in the short term by merchants to end users so as to capture the backwardation premium being offered by end users for spot deliveries. If merchants have product and they begin to sell this stock, then this will tend to depress prices both in the spot and forward market. This period is otherwise known as the off-loading phase. The length of this off-loading phase depends on the amount of old crop stock and the interim time to the new crop year when new deliveries would be expected. Generally, the off-loading time can vary from four to eight months.

Offloading by merchants during this fourth phase can often be misrepresented as a bearish market. Even some farmers who are hoarding may respond by panic selling. What originally appeared as a shortage now results in a surplus, albeit with old crop stocks. Usually these added stocks are more than sufficient for end user requirements and a contango returns to the forward market, while carry increases as warehouse space decreases. End users can delude themselves that surplus conditions have become permanent again.

The fifth phase is the real test for backwardation and it depends entirely on new crop production. There was a previous product shortage that was followed by a long period of off-loading stocks, which suggests that there is very little 'reserve' stock in the supply chain. It represents a time when the supply chain is very vulnerable, especially when imports are restricted. Any threat of new crop problems or product shortfalls or import restrictions causes forward carry to diminish and backwardation to return to the forward months. Unlike the fourth phase, this phase can be very quick and the vulnerability causes sensitive reactions to any new crop supply information. Such a period can be open to false information and manipulation.⁶⁶

If an actual new crop shortage occurs at a time when there are few old crop stocks remaining in the supply chain, such a double shortage causes prices to spike unless adequate imports are permitted. This represents the last and sixth phase of backwardation. If there are other contributing factors such as increased biofuel demand, import and export embargoes, overreaction by government import tender buyers, or added speculative pressures through increased hoarding opportunities and financial fund activity in the futures market, then price spikes such as occurred in 2007/08 are likely to result.⁶⁷

Basis and forward markets

Basis is the foundation of price, as in what is the basis for the local price. This suggests that price must have some relativity or connectivity to other prices for confidence to be established. International prices can have connectivity through exchange rate values. However, basis is more than just exchange rate differences.

Prices are rarely the same even for the same product in the same location. The essence of basis is the general acceptance of a benchmark price, and then using basis to explain differences between the benchmark price and the local price.⁶⁸ If the basis of the local price can be explained by being plus or minus to some benchmark price that has both liquidity and transparency, then there is a higher probability that the local price will be accepted with confidence by potential buyers and sellers. Local prices without some basis for determination are unlikely to be accepted for transactional purposes, which can cause the cash economy to descend into barter and countertrade.

Because price can be either spot or forward, there can be spot basis between two spot prices, or forward basis between two forward prices. Spot basis is more likely to depend on product grade differences, quality, local spot supply and demand, transport, old crop previous carry cost differences, lot size, type of delivery, and payment method. It is often debated whether the spot currency exchange rate should be part of spot international basis, however it needs to be included if basis is to have local relevance.

Whilst spot basis may be more easily determined, forward basis determination is unlikely to be anything more than a guesstimate. After all, if there was a liquid and transparent local forward market, then there would be little need for an external forward benchmark. Factors that could influence forward basis include differences in monthly carry costs, and the contango or backwardation characteristics of the old and new crop forward markets which probably reflect some different expectations of supply and demand, and old-new crop year differences. It should also account for forward currency exchange rates.

Basis is removed when a flat price is determined in a product transaction. Until there is a flat price determination, there will be basis risk, which should include currency risk. A fixed price forward contract will remove forward basis risk as well as forward currency risk.

Spot basis assists in immediate buying and selling decision making, whereas the knowledge of forward basis encourages forward buying and selling as well as forward pricing. Similar to carry, it is not the amount of basis that is seemingly important, but rather the trend or movement over time. Basis movement can influence buying, selling, hedging, and storage decisions.⁶⁹

If the price discovery benchmark occurs in Chicago because of liquidity and transparency, then there can be a US domestic basis for local transactions, and an international basis for foreign transactions, each of which can be plus or minus to the Chicago benchmark price. On the assumption that the Chicago benchmark price is the futures market price, it can be argued that the benchmark should effectively reflect the underlying Chicago commercial trade market price.⁷⁰ However, US corn basis reached US\$2 per bushel cash over futures price during May and June 2013, which reflected a serious market price distortion occurring.

Basis between a local price and a domestic benchmarked price would be expected to be small, irrespective of whether it was spot or forward. This may be a good outcome for both physical forward contractors and for those wanting to manage price risk, although there has been evidence to the contrary.⁷¹ Basis risk and currency risk tend to increase dramatically whenever relevancy and currency movement become major issues with international benchmarks.⁷² International port-based benchmarks such as for sugar and coffee can decrease basis risk, however adverse currency movement risk remains.

If the international benchmark price is based up-country, such as Chicago with a highly variable barge freight cost to New Orleans as the closest international port, then the basis with international prices can be large, particularly when added to the risk of adverse currency exchange rate movements. High basis and currency risk can destroy benchmarking ability and decrease the effectiveness of hedging price risk.⁷³

Some have argued that price benchmarking should be based on relative global production importance, irrespective of basis and currency risk. However, international benchmarks are characterized by differences in old and new crop carry policies, annual warehouse maintenance schedules, seasonal old crop price discounts, and major cropping year differences between northern and southern hemispheres. Attempting to benchmark local old crop prices off international new crop prices, or local new crop prices from international old crop prices, is fraught with basis risk and price adjustments, as well as currency risk. Therefore, there is a strong argument for domestic price benchmarking mechanisms that have consistency, relevancy, and liquidity in both spot and forward months.

If supply chain inefficiency prevents an effective commercial trade market from underlying a liquid futures market that could act as a domestic or international benchmark, then spot and forward basis become rather meaningless. This occurs for pulse crops, whose supply chains in a country such as India struggle to gain efficient spot and forward price signals because of intervention disruptions, price distortions, trade barriers, manipulation, and corruption.

3

PROBLEMS WITH RISK MANAGEMENT

Risk may be measured through probabilities,¹ but the management of risk can be extremely difficult. The spectrum between risk analysis and risk management can be wide and fraught with new risks. What seems to be very apparent to the uninitiated may not be very apparent to the more experienced.

The opportunity cost concept by Bastiat took decades before its recognition in finance and accounting.² But it is the management of financial losses and the opportunities foregone that makes price risk management so important yet controversial. The management of price risk often contradicts the profit maximization ideal so desired by many shareholders and farmers, particularly those who are struggling with profitability.³ A paradox may result for those who strive for profit maximization with no risk management, as was the case for many farmers in 2007, which often ends with loss maximization, as instanced in 2008.

What may appear as an opportunity in a food or fibre supply chain today may result in a cost or be high risk tomorrow. Opportunities, costs, and risks are interwoven and made dependent on market position, and can be interchanged over time through trade-offs. When combined with large physical risks as is the case in marginal farming, the paradoxical psychology relating to price risk management makes decisions extremely difficult.⁴

Farmers may look at prices going up, and then watch them going down, and then want government to fill the opportunity gap in lieu of any price risk management.⁵ However, alternatives to price risk management such as

subsidies, income support, price controls, 'buffer' stocks, and 'stabilization' schemes can create dependency problems, destroy product value, demean farm output through commoditization, and may result in supply chain stagnation with critical investment moving to other countries.⁶

Diversity in deregulated supply chains creates opportunity at the same time it increases risk and complexity. Every product is different and no supply chain is alike. The alternative can be simplistic economic policies to seemingly reduce risk and complexity through economies of scale and standardized commoditization, but which can remove private initiative and supply chain functionality.⁷

Generalizing over risk is difficult as there are many risks and different types of risk transfer and management.⁸ Risk decision making can involve a psychological belief of being damned if you do, and damned if you don't, but it simply cannot be ignored.

Decision making regarding risk and uncertainty

Specific risks such as income, price, and costs can be isolated, identified, measured, analysed, and theoretically managed.⁹ In contrast, the uncertainties associated with weather and biological factors cannot be readily isolated, and they cannot be easily managed.¹⁰ Irrigation may reduce yield uncertainty in some regions, but that introduces new risks such as water continuity, cost, sustainability, and salinity.

The use of weather derivatives in Australia failed because of huge rainfall variability, even within the same paddock, thus creating major differences between even nearby official measurement stations.¹¹ This was aggravated by major data transmission and surveillance costs and the risk of moral hazard such as tampering or corruption.¹² Farmers could be bankrupted because they had no rainfall, yet had to pay huge cash settlements at maturity of the weather derivative product due to official recordings at some distant measurement station.

Variability undermines the capability to make adequate decisions.¹³ Luck can replace good management, while chance can destroy competency. Hindsight ultimately determines what are good or bad decisions, but that does nothing to assist prior decision making.

Managing change is difficult, but essential.¹⁴ The key tactic is to know when it may be best to do nothing and when to do something. The act of doing nothing can be a quite legitimate strategy in price risk management. However, doing nothing because of nonchalance may result in panic reaction when conditions change, and it can be influenced by peer group

pressures rather than any rationale in decision making. The answer may lie in the adoption of flexible strategies.

However, flexibility is interwoven with cost and opportunity. There are many ideals in management decision making, but weaknesses in transaction cost, availability of alternatives, liquidity, and risk trade-offs.¹⁵ What may be possible may not be available or feasible, simply because risk needs to be transferred to someone else who may be unwilling to take on the risk without adequate compensation.

Decentralized organizational structures may have more flexibility in decision making and encourage initiative, but they may come at a cost and higher risk.¹⁶ In contrast, more centralized organizations may have less cost and risk, but they can have less flexibility and motivational initiatives. Uncertainty may require greater organizational control, but the lack of flexibility can destroy that control.

Risk decision making under high uncertainty can be extremely emotional. Selling and pricing decision making by farmers can result in a high percentage experiencing emotional anxiety, even after the decision has been made,¹⁷ but this depends on the region and the type of selling and pricing method.¹⁸ Actually producing food and fibre is sometimes the easiest part of the farming cycle because of the emotions that are involved in deciding how and when to sell to obtain the highest price. Farmers in more marginal production regions can experience extremely high emotional anxiety over selling and pricing because of low profitability and debt repayment pressures.

Prolonged regret can lead to avoidance of previous decisions.¹⁹ Mistakes can be repeated by having made a wrong decision, and then making another decision to avoid ever making that decision again, despite changed circumstances. Avoidance is based on the erroneous assumption that the exact same circumstances will be repeated. Ironically, previous seemingly correct decisions may have been by chance. When change dynamics occur, and the decision maker has restricted choice in decision making, what appeared to be the previous correct decision now becomes the wrong decision. The solution may be to never restrict decision making based on past outcomes, despite pressures to the contrary.

Regret and avoidance are emotions that can prejudice lessons learnt from experience.²⁰ If circumstances continually change, as they do under the uncertainties of weather and commodity prices, then learning from experience becomes highly questionable. It may be best to treat every day as something completely different to all previous days. If there was any predictive knowledge from past experience, most elderly people would

be extremely wealthy and living quite independently from government support.

Wherever there is high variability in production, there usually is high variability of price, unless there are monopoly or government intervention distortions. Farm decisions are then exacerbated by positive price skewness that disadvantages farmers.²¹ This contrasts with end users who are compensated for supply and price variability by the advantages from the skewness in price. There is bias towards end users in the probability of making correct decisions.

As uncertainty and income risk increases, individual decisions regarding selling and pricing become more desperate. Profitability and debt repayment are usually critical issues in more marginal production regions.²² Group product commingling and commodity pooling are more likely to occur in marginal production regions that are devoid of end users who are discouraged by delivery risk and product default.²³ Increasing dependency within the group usually erodes the willingness of individuals to singularly manage risk.²⁴

Some farmers believe that a group can solve the dilemma of uncertainty of production and price, despite the propensity of the group to become price takers.²⁵ Group production-push policies and increased commoditization of product usually lead to greater alienation from both domestic and international supply chains. The group can descend into political rivalry and leadership power struggles in the desire for unachievable market power,²⁶ which can be a business psychological distraction that numbs the reality of unprofitability.²⁷

Perceptions of risk

Risk should be a relative concept. However, unless farmers have experienced a range of different country risks, then they are unlikely to be able to benchmark risk between different regions. Risk then is often reduced to individual perceptions which are limited by personal local experiences, and are prone to mood swings between apathy and exaggeration.

Recall, experience, and mood variation can influence risk perception and attitude. What may be high risk to one farmer is low risk to another farmer under similar circumstances; what is perceived as high risk today may be perceived as a simple challenge tomorrow; and what is perceived as risk in one situation may be entirely different if specific factors change.²⁸

Individual risk behaviour can therefore change with circumstance. A farmer can be a risk taker with unsold product, yet be risk averse in financial

investments. Risk behaviour is often not consistent in the psyche of an individual, particularly when it involves farming.²⁹ This inconsistency destroys any simple categorization of individuals into risk averse and risk taking.

Experiencing risk over a period of time can reduce the perception of risk. Regular exposure can weaken the perceived danger of risk, which can create the problem of reducing the ability to recognize the real risk. This is likely to occur with farmers in more marginal producing regions, and it explains why they can become distracted by group dynamics and politics. Risk recognition needs to be followed by subsequent individual action, which may require shifting farming to a less marginal region rather than worsening their position in the supply chain.

Perspectives of risk can change dramatically between countries. A 50 percent loss in grain production in either Canada or Australia would be perceived as devastating for local farmers and for those end users who are prevented from importing. However, a 5 percent fall in US corn production can be perceived as 'catastrophic', despite it being the same tonnage as a 50 percent decrease in either Canada or Australia. Some end users can easily use substitutes or absorb input price increases because they are minor compared to the costs of product transformation and logistics, whereas others cannot.

Single risks may have inconsequential outcomes whereas a simultaneous combination of adverse risk occurrences might have catastrophic consequences. There needs to be some preparation for such risk combinations, despite such improbability and infrequency.³⁰ Multiple adverse risk occurrences need to be factored into worst-case scenarios in business management.³¹

Uncertainty and risk management

If uncertainty is required to make a profit,³² then using the same analogy, uncertainty is required to make a market. If everyone thought that the market was going up, there would be no sellers. Alternatively, if everyone thought that the market was going down, there would be no buyers. Transactional activity in markets can only be developed through uncertainty.³³

If high uncertainty has a huge impact on risk, the associated trade-offs may diminish the ability to manage those risks.³⁴ The corollary is that more certainty increases the ability to manage the risk, but paradoxically there is a lower need to manage such risks when greater certainty exists. This is the uncertainty-risk dilemma encountered with any risk management, and which is similar to the actuarial predicament in the insurance industry.

Complete integration is the ultimate risk management strategy in the food and fibre supply chain, however it is expensive and still dependent on uncertain product supply. Uncertainty can both drive and destroy supply chain integration.³⁵ As uncertainty increases, the successfulness of integration may decrease, which can explain why more marginal producing regions are usually geographically isolated from active supply chains.

It can be argued that spreading risk through business diversification is not risk management, especially in drought years. However, specialization in production and supply chains usually increases risk and makes risk management more essential compared to more diversified production and supply chains. Specialist farmers are therefore more likely to be focused on managing price risk compared to more diversified farmers.³⁶ However, agronomic and weather factors can remove the choice for farmers as to whether they are diversified or specialized.

Highly specialized niche supply chains are vulnerable to production uncertainties, changes in consumer or customer needs, and singular external risks, but may have a higher profit margin to absorb increased costs. This contrasts to volume-driven opportunistic risk-spreading supply chains that may absorb supply chain change dynamics and singular external risks, but have less ability to absorb increased costs. The length of the supply chain may have some proportionality to risk, as well as costs.

Perceived value adding may or may not create extra value to the customer and may not achieve a higher average price. Much depends on the product specification demanded or what the buyer actually wants. Regardless, any higher value or price merely adds to the risk of prices falling, or profit margins narrowing, which can require additional risk management. Value adding does not reduce uncertainty or manage price automatically. At worst, the added value might be perceived by the buyer as merely meeting original product specifications. A buyer can easily be offended when informed that the product is better, which implies that the original product was inferior.

It is often assumed that insurance should be a method to manage income risk. The problem is that the insurance premium is directly related to the risk of loss, which increases as uncertainty rises.³⁷ If uncertainty is extremely high, as in biological and weather dependent marginal agricultural production, then insurance premiums to manage the risk of loss is prohibitive, even for governments.³⁸ Wherever farm production is more certain, taxpayers in countries such as the USA and Canada have subsidized farming insurance premiums, which enables risk cover to be taken against some yield losses and quality downgrades.³⁹ Direct farm subsidies and income support can be perceived as *de facto* insurance schemes paid by taxpayers.

Offsetting risks internally is a legitimate method to manage risk. An example is when a company is both an importer as well as an exporter and can neutralize currency position risk. Size of operations can determine both the ability to internalize the risk within an organizational structure as well as spread the risk through diversification.

Risk trade-offs

Whereas markets are based on uncertainty, effective management of risk is reduced by uncertainty. The irony is that most price risk management is undertaken under uncertainty through markets that are also uncertain. Attempting to manage one risk invariably introduces new risks whenever uncertainty is high. The risk trade-offs for a farmer prior to harvest might alter dramatically after harvest.

Managing price risk prior to harvest through integrative forward contracts can introduce the risk of product specification, delivery, timing, and default. Offsetting prices externally can introduce the risk of basis, currency, and settlement losses in derivative hedging.⁴⁰ When combined with production uncertainty, the risk trade-offs involved with price risk management prior to harvest may be prohibitive for farmers and some merchants, which can inhibit the motivation for integrative supply chains linkages and thus promote opportunistic behaviour.

The irony postharvest is that the product is relatively certain, yet many farmers prefer price uncertainty because of opportunistic behaviour, which may be driven by low profitability desperation that is aggravated by low yields. Both hoarders and poolers defer cash sales, with potential risk trade-offs being insufficient cash flow, price and currency risk, product shrinkage, product risk that is reflected through old crop price discounts and commercial trade discounts, the time value of money and opportunity costs, and price skewness probabilities.

There is an alternative, which is to enhance postharvest price by selling the physical product and then buying call options, which are derivative instruments design to profit from upside movement.⁴¹ However, the trade-off with this strategy is the premium cost, market illiquidity, and time to monitor market positions.

Pricing opportunities and risk

The linkage between risk taking and risk management may be weak,⁴² which can cause a big schism between the ability and willingness to manage risk. Risk taking in uncertain production supply chains cannot imply

that sellers and buyers will somehow simply revert to being risk averse and manage price risk. Human behavioural decision making generally does not function with such contradictions within short time frames.⁴³

Farmers may change their risk attitude under different circumstances, but that does little to change uncertain production when deciding whether to manage price risk prior to harvest.⁴⁴ At best, farmers may be more likely to increase their price risk management when yield and quality have more certainty at various stages of crop advancement.⁴⁵

What is more behaviourally consistent is that some farmers perceive managing price risk to be risk taking,⁴⁶ which therefore does not contradict their basic human behaviour and risk attitude. Under conditions of high production uncertainty and large transactional cost risk associated with basis, currency, margins, and settlement risks in managing price risk, some farmers perceive themselves as risk takers whenever they attempt to manage price risk.

Product is the essence of food and fibre supply chains, which suggests that without some certainty of product, there cannot be price risk management. Irrigated cotton growers with greater production certainty are likely to be more conducive to managing price risk.⁴⁷ In contrast, farmers with high production risk and large debt are extremely unlikely to be willing to manage price risk, despite their vulnerability.⁴⁸ Speculation in agricultural production is likely to be followed by speculation on price. This risk management behaviour may not reflect any market failure⁴⁹ such as low liquidity or adverse basis movement, rather it suggests behavioural differences towards risk perceptions, attitudes, and risk management.

The skewness of agricultural prices⁵⁰ can discourage both end users and farmers in managing their price risk. End users only have spasmodic price risk due to skewness of prices and may choose to absorb periodic losses in lieu of the cost and risks associated with managing price, even though they have far more opportunities to lock in low prices than farmers have to lock in high prices.

End users may prefer supply agreements which do not lock in price and thus avoid tradeoffs such as opportunity losses and transactional costs. Avoidance of managing price may maintain longer term competitiveness as well as keeping shareholders satisfied, on the understanding that the occasional upside loss is absorbed within business operations, especially when input prices are low relatively to output prices.

Similarly, farmers struggling with low profitability after long periods of low prices may reject price risk management in lieu of higher price speculative opportunities to enhance income, especially when price is below cost of production.⁵¹ Ironically, farmers frequently miss high pricing opportunities

before prices fall again, while others attempt to pick a price peak as if this was possible without risk. However, on the assumption that a high price was locked in, then price skewness usually favours those farmers who manage their price risk, provided that there is sufficient time for prices to fall.

It could be that a fundamental shift to a more 'normal' distribution of prices would achieve more balance between the opportunities and risks for both end users and farmers, and therefore more incentive to manage price risk. The irony is that this could introduce higher risk for farmers who undertook price risk management through trade-offs, added costs, and opportunity losses, but improve the advantage of farmers who did not manage their price risk. As well, a more 'normal' distribution of prices could discourage end user investment in supply chains because of the higher input price risk, thereby increasing supply chain insecurity.

Adoption factors

There are many production-related factors that can impact the amount of business risk and the ability and willingness to manage risks.⁵² Economies of scale, farm debt, farm land ownership and succession issues, operational finance and capital investment, and human resources can impact risk and the motivation to manage specific risks.⁵³

Greater certainty over rainfall and agricultural production in food bowl countries such as the USA and within Europe might suggest a higher motivation for individuals to manage price risk, yet these countries are more reliant on farm subsidies and income support, with relatively low rates of individual adoption of price risk management practices.⁵⁴ Farm subsidies can promote private on-farm hoarding in lieu of price enhancement strategies because they remove the cash flow imperative that drives spot sales. This contrasts with countries with high marginal production uncertainty which do not have farm subsidies and income support, but which have comparable or higher price risk management adoption rates in some years despite the risks involved.⁵⁵

Cost of production is an unlikely factor in the adoption of risk management practices. However, 40–60 percent of surveyed Australian wheat growers in different regions agreed that they target more realistic price levels in risk management when variable costs are known.⁵⁶ Alternatively, 38–45 percent of surveyed Australian wheat growers agreed that price risk management acted as an incentive to lower variable costs of production, albeit those that are discretionary. Cost knowledge and control can be closely associated with the management of price for some farmers irrespective of

how the costs are calculated, but this does vary between geographical and presumably biodiverse regions.

Adoption rates assume that there is a local mechanism for implementing price risk management at low risk and cost. Most countries do not have functional parallel domestic derivative markets with some critically minimum transactional volume which would facilitate the transfer of local price risk. Without such domestic offsetting facilities, there is a reliance on North American markets to manage price risk internationally. The trade-off for international price risk management is basis and currency risk, particularly for up-country markets such as in Chicago, Kansas City, Minneapolis, and Winnipeg.⁵⁷

Any supply chain signal dysfunction and price distortion are highly likely to reduce forward market activity and destroy any motivation to manage price risk.⁵⁸ Adoption rates of price risk management are negligible in countries with price controls and disproportionate public to private supply chain buying, as evidenced by low transactional volume in Indian futures markets.⁵⁹

Forward contract risk

The primary price risk offsetting mechanism is the forward contract, which explains the focus on integration into commercial trade markets through forward supply chain agreements. However, such seemingly simplistic risk management agreements are far more complex in reality, with legal precedent expanding each year and government legislation on contract law forever being refined.⁶⁰ Initially perceived win-win situations can change into lose-lose situations for both parties, particularly when future circumstances are altered, thus forcing product delivery default.

Fulfilling the obligations of an agricultural forward contract in countries that enforce contract law largely depends on delivery of a specified biologically-produced product on the agreed date and receiving payment. The more marginal the production region, the greater is the likelihood of contract default, especially when drought and temperature affects yield, and disease and pestilence reduces product quality.⁶¹

Contract default necessitates a cash settlement in lieu of product delivery, with the amount of risk depending on market price movement relative to the contracted price. There is a false presumption that because cash settlement involves debits and credits on an account ledger that there is a win-lose situation. That may be the financial outcome, but if a contract default leads to supply chain disintegration, it is a lose-lose situation throughout the

supply chain including a loss of customer goodwill.⁶² Nobody wins if the final customer or consumer is dissatisfied, which is something that farmers at the other end of the supply chain frequently overlook. Supply chain goodwill is easy to lose but difficult to gain.

Tactics reducing contract default

Contract default in agricultural contracts has had a long history of dire consequences for farmers, merchants, and family members.⁶³ Farmers were still being hanged under British law for contract default at least until the 1830s.⁶⁴ There was much urgency to buy from alternate sources, including other farmers, and deliver such product against the contract. However, this required waiting until harvest with the risk that competitors could buy all available product.

The alternative to contract default prior to harvest was to transfer the forward contract to another seller who could deliver the required specifications to the buyer against the contract. These transferred contracts were not bought or sold, rather they were exchanged with a margin being settled based on the difference between the current market price and the forward contract price.

Under shortage conditions and rising prices, margin settlement involved the initial seller paying the new seller the difference between the current high market price and the forward contract price. In the unusual event of prices falling and the original seller unable to buy in, then the new seller would be required to pay the initial seller the margin difference.

Margin settlement therefore had to occur with transferred contracts regardless of market price direction. The end user as the ultimate buyer in the contract was not concerned over these contract transfers and margin settlements, provided that the timely delivery of the specified product occurred on the due date. If the final seller did not meet the delivery requirements of the buyer at settlement, then legal repercussions would occur.

There is a historical debate over whether legal action should have been against the original seller or the final seller, with contract transferees claiming innocence. However the real issue was that someone needed to be held responsible for the contract default. The law that evolved generally made the person currently holding the contract as a transferee liable for settlement. This meant that the name of the seller should have been changed and witnessed for each transfer of the seller's contract document.

If there were many such forward contracts being transferred within an agricultural region and with similar types of end users, such as milling

wheat for flour manufacturers, then it became more efficient for the forward contracts to be standardized according to the quantity, quality, and place of delivery. Over many thousands of years, such transferable standardized contracts otherwise became known as futures contracts, particularly when a central market-place was established specifically to trade such contracts. Thus there was a gradual evolution of futures markets, with the irony that they were developed to facilitate the seller and not the buyer.

However, transferring market position risk via tradable standardized forward contracts in a centrally traded futures market introduced new risks, such as margin settlement risk, which then introduced credit risk, asset security risk, and cash flow risk. There had to be internal governance over personal asset security through a central clearing house to manage settlement risk. Formal organizations and procedures had to be developed.

Another problem was having sufficient volume being traded, and market interest as expressed through the number of opened contracts, in order to justify such a central market for trading standardized forward contracts. Merely having a central clearing house and formal organizational procedures did not create liquidity or a market, except maybe for cash-settling speculators.

Market activity as measured by liquidity should be linked to supply chain relevance.⁶⁵ If there is little or no underlying commercial trade activity, then futures market relevance will be low and speculative activity could be high.

A strong spot commercial trade market without strong forward commercial trading is unlikely to support a forward futures market because there is no foundation to derive a futures market. The forward futures market needs to be based on an underlying forward commercial trade market to establish forward market relevancy and effectiveness in price risk management.

Basis risk

Whilst basis is the difference between a local price and a benchmark price, basis risk measures the effectiveness of offsetting price with an opposite market position, which is otherwise known as hedging. Basis risk is removed in a physical forward contract because the local flat price locks in all components of price, which could include futures, basis, and currency.

Whenever price risk is offset by locking in an external benchmark price in a hedge, basis risk occurs. It reflects the parallelism between the local price and the external benchmark price. Basis risk is the risk that prices will not move parallel in a hedge. The higher the basis risk the more likely a hedge will be ineffective. An effective hedge has high parallelism that can

offset prices with low basis movement. There is low basis risk in price risk management for a sugar exporter using ICE sugar futures because of the global export port-based futures price and product homogeneity.

Basis movement during the duration of a hedge can be advantageous or disadvantageous. What is advantageous for one hedger, either the buyer or seller, is disadvantageous to the other hedger. It is usual to associate basis risk with the disadvantaged party through negative outcomes in the final realized price. Based on the assumption that the physical price exposure was 100 percent offset in the hedge, then basis risk measures the difference between the initial physical target price and the final physical realized price. Alternatively, basis movement in a hedge can be measured by the difference between the initial basis and final basis.

The risk of adverse basis movement in a hedge can be eliminated by delivering against a futures contract, which is a similar situation to eliminating basis risk when delivering against a physical forward contract. Basis risk therefore is a hedging issue whenever delivery does not occur against the futures contract.

Factors affecting basis risk

Many factors can influence basis and therefore basis risk. The greater the distance from the external benchmark price, the higher will be the risk of adverse basis movement in a hedge, particularly in international hedging.

Product or grade basis occurs when there are inter-regional and country differences in a biologically produced product that will invariably result in price differentials based on different product characteristics. The movement of these price differentials is important during a hedge. There are likely to be product or grade differences between the local product and the standardized specifications of a benchmark futures contract which can increase basis, but it is price movement differences during the hedge that creates basis risk. There may be a bareme of price premiums and discounts when delivering against a futures contract, which may permit some product differences. However, this allowance for product differences cannot apply when not delivering against a futures contract.

Delivery basis occurs when transport costs cause major price differences between a centrally-derived price and a local regional price, or between a free-on-board (fob) origin port futures price and a cost-insurance-freight (cif) destination port physical price. Such delivery basis often depends on whether the product is exported, in which case domestic transport cost will be deducted from the port price, or whether the product is imported, in

which case domestic transport cost will be added to the port price. Volatility in the cost of transport, such as the Mississippi River barge freight cost, is more likely to be reflected in high basis volatility.⁶⁶

Locality basis is the result of biological and demand influences as well as weather conditions, which can alter product supply and demand in different regions and countries. Demand conditions would be expected to vary between regions and countries depending on the type and number of end users or consumers. Differences in supply and demand conditions within and between countries could be high, and this is reflected in basis movement and risk during the duration of a hedge.

Time basis relates to forward basis, which has a time element based on carry charges. On the assumption that the local forward market is based on carry charges, local carry differences compared to the offsetting market carry can affect forward basis risk. Carry or backwardation forward market movements are unlikely to exactly match between the local and the offsetting market, thereby creating forward basis risk.

Attempting to offset old crop with new crop in the benchmark market, or new crop from old crop, can influence time basis. This could create large volatility in basis and decrease the effectiveness of any international hedge, especially when there are major crop year differences between the northern and southern hemispheres.

Exchange rate variability can seriously influence basis risk whenever there is an attempt to offset the price in one country against a price in another country.⁶⁷ Local prices can move quite independently to the international benchmark price because of currency movements. If currency movements depend on monetary factors such as interest rates and inflation, then these factors can have an influence on intercountry basis and the ability to effectively offset price risk in the supply chain. Currency risk may be considered separate to basis risk, particularly from a US perspective where prices are in US dollars.

4

POSITION, DEFAULT, AND VALUATION

Price risk is caused by establishing a market position which reflects the direction of risk exposure. Alternatively, the direction of price risk exposure determines the market position. If the price risk exposure is on the downside, there is a long market position. In contrast, if the price risk exposure is on the upside, there is a short market position. No price risk exposure results in a neutral market position. There are only three market positions—long, short, and neutral.

This position-based risk exposure principle applies regardless of whether the market is physical, derived through a futures or options market, or privately created by a bank. It is applicable to all agricultural, energy, mineral, currency, equity, and interest rate markets. The one exception to market position is the bond market, where price is inversely proportional to yield.

Farmers, end users, and merchants cannot be simply categorized in a market position. A farmer is not always long, an end user is not always short, and the market position of a merchant can be quite complex, which might be expected when an organization is willing to take on risk and absorb it within its own operations. A merchant business that continually buys and sells will have varying market positions during the day, which requires the netting of market positions with final exposure determined at the end of each trading day.

Long market position

The farmer who has expended money in the expectation of producing a product has downside price risk and is therefore long, even though there is no final physical product until harvest time. A market position is established

for a farmer as soon as the first production expenditure is incurred, which might be for seed, fertilizer, and fuel, months before planting. Also, a farmer who delays selling after harvest by storing or pooling has downside price risk and is therefore long.

An end user or merchant who buys more product than is required for immediate needs has downside price risk and is therefore long. As well, an importer who holds domestic currency or an exporter being paid in a foreign currency has downside risk with the particular currency being held and is therefore long. A Chinese exporter holding or receiving US dollars is long in US dollars. A lender who is disadvantaged by interest rates falling is long as well.

Short market position

An end user who needs product for immediate requirements has upside price risk and is therefore short. The end user will be short until procurement has occurred and a neutral position achieved, at least in the interim period. Perhaps tomorrow the end user may again be short because more supply is needed to be procured, with the price risk re-established on the upside.

A merchant who has forward sold but has insufficient inventory has upside price risk and is therefore short. The farmer who has forward sold but has insufficient production to deliver has upside price risk and is therefore short. Similarly, an exporter who needs to receive domestic currency or an importer who needs to pay in a foreign currency has upside risk with the particular currency and is therefore short. A Chinese importer needing to pay in US dollars is short in US dollars. As well, a borrower who is disadvantaged by interest rates rising is also short.

Neutral market position

If there is no market position, there can be no upside or downside price risk. The lack of final physical product does not define market neutrality because long or short positions can still exist. A farmer establishes a long position before the final product is harvested, and a merchant can be short with a shortfall in inventory.

Alternatively, there can be market neutrality even though physical product is being held. A back-to-back transaction might require stored inventory of forward sold product, whereby a forward purchase is neutralized by a forward sale. Another neutral strategy occurs when an original market position is offset with an equal but opposite market position in a hedge.¹

Merchant positions

A merchant can be characterized as a risk taker with no fixed market position, yet merchant business survival depends on managing the array of risk. Therefore, a merchant should best be described as a risk manager. Most merchants would attempt to manage their market position risk either by back-to-back transactions or internalizing their exposure within their operations.² Inadequate management of risk can ruin the merchant.

If there is accumulated product with no sale, the merchant is long because price risk is on the downside. Alternatively, if there is a need to accumulate product because of a forward sale, then the merchant is short because price risk is on the upside. A balance between forward sales and forward inventory would create a neutral market position.

A merchant could initially be neutral by having no stocks or forward commitments, but then undertakes a forward commitment to buy. This then establishes a long market position. Alternatively, a merchant could initially be neutral by having no stocks or forward commitments, but then undertakes a forward commitment to sell. This then establishes a short market position.

Importance of valuing market exposure

The immediacy of a spot transaction removes market position risk for that quantity transacted. In contrast, forward transactions have a time element involved with market position risk, which exists until the risk is neutralized or offset. Management may attempt to remove, offset, or minimize the forward exposure at any time.

Forward market position risk exists until a neutralizing transaction is undertaken. However, any physical forward contract has the risk of contract default at settlement. Therefore there is a need to value the risk for the duration of the potential exposure within the contract period, which explains why management, accountancy, and law become intertwined in forward situations.

Whenever there is a fixed price in a forward contract, there will be market position risk that is valued by the margin difference between the forward contract price and the current market price. This market position risk should be valued daily based on daily margin variations for auditing purposes and to meet current international accountancy standards. For adequate credit control, there should be daily margin settlements.

It is the mandatory daily margin settlement that is the primary difference between a forward contract and a futures contract that is merely a

transferrable tradable standardized forward contract. The mandatory daily margin settlement of a futures contract requires a centralized futures exchange establishing margin procedures through a daily closing settlement price, and a clearing house for the margin settlement transfer mechanism. Whilst it is mandatory for futures contracts to be daily valued and margin settled by the futures market clearing house, it is not mandatory but good practice by private management to value all physical forward contracts regularly.

Apart from physical delivery, the only method to decrease credit risk in a physical forward contract is to cash settle periodically between the buyer and the seller. Otherwise, settlement credit risk for either the seller or buyer could reach unmanageable proportions if a contract default occurred. The problem for a farmer as the seller in a forward contract is that there is no cash flow occurring until delivery, which makes periodic prior cash settlement difficult. If contract default by a farmer is inevitable because of adverse production conditions, then any attempt to extend the time of delivery in a roll-over of the contract to the following year is only going to increase the settlement credit risk.

Title transfer

The transfer of ownership title is extremely important in determining market position risk. Defining where title transfer occurs and when market position exposure begins and ends is a vital component of price risk management decision making. Clear demarcation of title transfer clarifies risks and responsibilities regarding price, currency, costs, finance, and investment.

If physical delivery and payment occurred simultaneously, then ownership title transfer might be a simple process. The farmer delivering product would go from long to neutral, while the buyer could become either neutral or long. Market position altered with title transfer. But rarely is the transfer of market position so simple in agricultural supply chains.

Product commingling or product transformation introduces complexity into ownership transfer, because of problems with identity preservation and delays in transferring title. Payments that are delayed and based on prices in the future extend both the market position exposure of the seller as well as the cost responsibility. Some proponents for commingling claim that the postharvest collective benefits of deferring sales and averaging price outweigh the risks of extended market position and cost exposure.³

Problems can arise with product processing where the exact stage of title transfer is not readily transparent. A grower may deliver sugar cane but get

paid by the miller based on raw sugar at a future time. There is the question as to whether the mill is buying cane or sugar from the grower, and just where does the long market position of the grower finish and the long position of the miller start. The market position and pricing is based on sugar, yet the grower delivers cane that needs to be processed to determine sugar content.⁴

An initial solution is for the growers and miller to agree on an exact point of title transfer, which is often determined at the point where the cane is unloaded by the grower. As soon as the cane is tipped into either a rail wagon or hopper bin which is owned by the mill, product ownership and responsibility can be transferred from the grower to the miller, even though payment is based on a subsequent processed product. The problem now is that the grower can still incur downside sugar price risk and upside currency risk until payment is made on the raw sugar after milling, despite the grower not having any legal ownership of the product.

One answer to this problem lies in pricing processed sugar for the grower on the day that the cane was delivered and not on when the sugar was sold, regardless of any prior allocated delivery dates. It can be argued that sugar market position risk for the grower should end when title transfer occurs with cane being delivered, whilst the miller should bear market position risk and price exposure after the initial delivery. This requires individual grower pricing, which causes much more accounting work for the mills, and which somewhat explains why some millers have supported averaged price commodity pooling and government mandated retention of product ownership by farmers.

Forcing growers to retain product ownership and market position exposure either through mandatory commodity pooling or cooperative pooling extends the product ownership and price risk of growers to the sale date of the raw sugar, which is way beyond the date of cane delivery. The miller then has no market position price risk because that responsibility has been retained by growers, sometimes 18 months after delivery of the cane.

It can be argued that the role of the sugar miller lies in technological processing and product transformation and not in becoming a merchant. This might suggest that there is a role for raw sugar merchants who can buy cane from growers and contract out processing operations to milling specialists in toll-milling, rather than any need for government intervention or mandates. The merchant could finance and pay a spot price to the grower upon delivery and title transfer of the cane, with price adjustments based on sugar content after crushing has occurred on the same day.

Alternatively, food manufacturers could buy the cane, toll-mill the sugar, and provide early payments to growers. It is becoming increasingly common under supply chain deregulation for food manufacturers to own the mill and negotiate directly with cane growers.

Title transfer and market position risk also become issues when raw sugar is transacted between the miller and the refiner. The miller should be long, and the refiner could be short or neutral depending on forward sales. A transaction between the miller and the refiner could revert the miller to neutral while the refiner reverses market positions. Alternatively, a merchant or food manufacturer could buy the cane and own the raw sugar through toll-milling, and continue the product ownership by toll-refining. In this case of retained ownership, the merchant would be long and have full market position exposure until the refined sugar was sold, whilst the food manufacturer needing sugar would be neutral because of vertical ownership.

Title retention

There is debate as to whether farmers should extend their product ownership and market position beyond the delivery point, and questioning as to what are the implications on price and cost risk after delivery. There are some highly perishable products that are more suited to commingling, such as fresh whole milk that usually requires homogenization and pasteurization. Wine grapes also require immediate delivery once harvested, however they have very different product attributes.

If farmers extend their market position because of product value adding, then the question arises as to how adequate the price and cost risk are being managed, and how capable are the farmers in technological product processing, food or beverage manufacturing, corporate management, and retail marketing. Outsourcing management skills generally does not remove operational risks such as price, costs, currency, and profit. If farmers really want to retain some product ownership and share the profits of value adding in the supply chain, there usually are opportunities through private share equity rather than prolonging product ownership title and extending market position risk, whilst avoiding much anxiety in the process.

The perishable product situation is very different to storable products with no immediate urgency or commitment to deliver after harvest. Product ownership retention of storable products needs to be considered very differently to milk or wine because there is no value adding or rewards

for carry. Time can cause old crop commodity to become a wasting asset because its value decreases as new crop approaches, particularly when there is product risk to the supply chain. Price-taking storable commodity with inadequate crop financing and capital investment can lead to sales of last resort or tender queue discounting. Extending product ownership time and prolonging market position risk with unknown costs can increase supply chain risk to already high risk takers. A farmer cooperative can formalize the high risk into group risk taking.

Government mandate or legislated cooperative pooling forces farmers to retain their market position and cost exposure, which might extend until title transfer occurs at the destination port or foreign warehouse. In lieu of a local merchant who would normally have up-country title transfer with early responsibility of market position exposure and supply chain costs, regulation can force the farmer to bear all risks involved in price, cost, currency, product, freight, and supply chain up to 18 months after the initial product was delivered. It explains why international merchants had a very strong symbiotic relationship with market regulators during the twentieth century.⁵ Some farmers actively seek this added risk exposure for storable commodity rather than pass the supply chain risk responsibility onto merchants and food manufacturers.

The irony is that deferred title transfer of old crop distracts farmers from the new crop market position risk and price exposure. Maximum focus is usually on the 12 to 18 month postharvest price estimations for old crop rather than the 6 to 12 month preharvest price and currency exposure for new crop. Some farmers tend to ignore the preharvest price exposure and market position risks, and bear the consequences postharvest.

Issues in market position

There are many factors that can affect the market position risk for farmers, merchants, and end users in agricultural supply chains, regardless of whether an attempt is made to manage market position and price exposure. Trade-offs and paradoxes abound with market position exposure and risk management.

Doing nothing regarding pricing or transacting may merely continue an existing market position and price exposure. It usually defers ultimate decision making to a later time. A farmer might do nothing regarding market position risk and price exposure prior to harvest, and could defer any selling decision after harvest. However, anxiety, regret, and avoidance remain high even for farmers who do nothing.⁶

Some farmers pass the pricing and selling decision-making responsibility onto a collective group, a private pool manager, a discretionary broker, or sometimes even a merchant. However, transferring decision-making responsibility usually does not transfer the market position exposure or price risk. A decision to produce or store cannot be made devoid of a decision to ultimately price or to sell, except for seed, animal feed, or family sustenance.⁷

A decision to produce and establish a market position does not always result in production and price exposure. Marginal farmers may attempt production, but the outcome might be quite elusive.⁸ The market position exposure that was thought to occur may not eventuate. However, there is a cost recovery risk exposure if production fails to eventuate. Physical financial losses can be incurred through cost outlays, despite there being no market exposure through production.

Farmers in marginal production regions can be overoptimistic and overreact. Product could be sold before final output is known,⁹ or the quantity involved in managing price risk was excessive. The outcome could be contract delivery default or price speculation. Price risk is then converted into product delivery risk or margin settlement risk.¹⁰

Increasing marginality of agricultural production causes variability in the long market position risk for sellers,¹¹ whilst exacerbating the fixed short market position risk for buyers. The variability of long positions and the fixity of short positions create huge supply chain alignment problems,¹² which may only be solved by permitting imports to meet any product shortfalls.

End users usually have incurred huge initial capital investments and have large working capital outlays, and are very dependent on fixed agricultural supply for their throughput operations. Their whole operations can depend on product supply and neutralizing their fixed short position. Deliberately withholding product supply or the biological variability of marginal production can be a serious problem to end users.¹³ Any sustained supply-demand misalignment will cause end users to relocate elsewhere or close their operations.¹⁴

Market position risk exposure increases tremendously whenever costs are unlimited, such as incurring ship demurrage costs.¹⁵ There is a cost leverage which is often used to force changes to contract settlement. This contract power depends on whether the product is priced at the origin port or the destination port, thus making one party responsible for unlimited shipping and demurrage costs, which creates leverage for one party over the other.

One general rule is that product shortages and rising prices could result in the exporter being more willing to price destination port with the importer. Alternatively, product surpluses and the risk of prices falling might

result in the exporter demanding origin port pricing to avoid the added market position exposure. This is because the long market position exposure for the importer and payment default risk to the exporter is greatest when there are product surpluses and prices are falling. In contrast, delivery default risk to the importer might arise when there are product shortages and prices are rising, and the exporter defaults on the agreement and sells elsewhere at a higher price.

Exchange rate movement can increase market position risk exposure whenever domestic prices are dependent on international prices or whenever prices are internationally based.¹⁶ Currency risk is neutralized in the USA because much international trade is transacted in US dollars, however every other country has both domestic price risk and currency risk, which must be considered separately when determining market position risk.¹⁷

Contract default

The legal definition of default is the failure or neglect of duty to fulfill the obligations that were initially agreed upon.¹⁸ Default on any contract occurs when either one of the parties to the contract does not fulfill their legal obligations under the terms and conditions of the contract.

Contract clause terms and conditions are therefore paramount in identifying the circumstances for default. The law will primarily revert to what was agreed upon between the two parties in the contract.¹⁹ Whilst the initial intent is important in dispute resolution, interpretation can dramatically change with altered circumstances and hindsight knowledge. Court ruling precedents establish guidelines but only within highly variable parameters.

Default opportunism can arise for sellers if spot prices rose above the contract price, with sellers being tempted to sell into the spot physical market. Alternatively, default opportunism can arise for buyers if spot prices fall below the contract price, with buyers being tempted to buy from the spot physical market.

There is therefore a need for sufficient enforcement of both local and international contract laws to ensure the integrity of the contractual system, otherwise there may be deliberate default against forward contract obligations whenever one party is disadvantaged. Buyers and sellers will not use physical forward contracting unless there is trust in the legal system.

Regardless of any opportunism, contract default by a farmer can arise from an inability to deliver the physical quantity or specifications against the contract, usually because of the general lack of control over biological

production. Default could be caused by external human activity that may be described as force majeure, perhaps through a port labour union strike, or through some calamity that might be described as an act of god, such as a drought. Contract terms and conditions should include definition of what is an allowable force majeure or act of god.²⁰

Alternatively, bankruptcy of the end user or merchant could cause payment default by the buyer. A minor default by the buyer might occur when there is congestion at the designated delivery place, and the seller is directed to deliver the product to another site at higher cost. Such possible default eventualities should be included in the contract terms and conditions to prevent loss of mutual goodwill.²¹

If physical delivery intake is prevented by force majeure or act of god, then insurance might cover cash settlement on a defaulted contract in some circumstances.²² Most eventualities can be insured, but the trade-off is a high premium cost. Taxpayers pay up to 60 percent of some farm yield and income insurance premiums in the USA and Canada, with payouts contributing to cash flow for contract default settlement.²³

Operational breakdowns may not be justification for seller or buyer default on physical contractual obligations, unless it was specifically stated in the contract terms and conditions. However, the buyer is able to take delivery from elsewhere if the original supplier defaults on the agreed contractual terms and conditions.

Flexibility can minimize occurrences of contract default but within limits and trade-offs. Using multigrade contracts that usually have a base price with a premium or discount *bareme* depending on the product grade delivered can decrease contract default because the farmer only has to deliver product quantity rather than specific product grade.²⁴ Such contractual flexibility can be offered by opportunistic merchants who are prepared to speculate on physical product purchases, and maybe offset the associated price and currency risk through hedging facilities.

However, product is the key to agricultural supply chains, and any product grade uncertainty will seriously weaken the integrative benefits within the supply chain that rely on supplying specific product attributes to end users through origination. Those merchants who purchase opportunistically with product intake flexibility are undertaking accumulation for which there is no existing commercial trade purchase agreement. The result can often be delayed sales of deteriorating old crop product with last-resort selling at discounted prices.

The obligation to deliver product against contract can be made optional, but this again does little to enhance supply chain integration or indeed the

legal integrity of the original intent of the contract. A specific washout clause in a contract may imply that a seller or buyer can avoid their obligations to deliver or take delivery of the physical product, and be replaced by a cash settlement of the margin difference between the forward market price and the current market price. A buyer or a seller cannot simply ignore their legal contractual obligations.

It may be possible to assume default in a futures contract, but that is only because there are daily margin cash settlements. There is settlement each day in a futures contract, which facilitates the quick and easy exiting of positions and washout of contracts. In contrast, default cannot be assumed in a deliverable agricultural forward contract because the sole reason why a buyer entered the contract is to receive product supply from the seller, and because there usually is no provision for regular margin cash settlements before the delivery date.

The clearing house mechanism of a futures exchange makes it mandatory to value and cash settle the daily margins that are associated with a futures market position for both buyers and sellers of futures contracts as well as option sellers.²⁵ Daily cash settlement of the margin difference between today and when it was last cash settled removes any settlement risk involved with delivery default, thereby facilitating contract washout. The number of opened contracts at any particular time for each contract month on a futures exchange is reflected through the open interest or open position.

It is this optional product delivery that then allows speculators to enter a futures market and trade forward contracts, provided that they meet daily margin settlement obligations. These speculators add daily volume to a forward market, and lower the transaction cost by decreasing the bid: offer spread in transactions. It contrasts to the difficulty to cash settle against a defaulted physical forward contract when there are no ready credit mechanisms provided for cash settlement.

Types of default settlement

Apart from contract transferability,²⁶ there are four main types of delivery default settlement mechanisms that could either be included in the conditions of the forward contract or else negotiated privately through mediation whenever the potential for delivery default arises. Default must be considered against the original intent of the contractual terms and conditions. The four default mechanisms include cash settlement provisions, buy-in arrangements, roll-over allowances, and product substitution facilities.²⁷

Cash settlement provisions. Cash settlements depend on spot market price on the day of contract settlement relative to the forward contract price. If the spot market price is higher than the forward contract price, the seller pays the value difference to the buyer. The problem is deciding on a spot market price when the previously decided spot market becomes illiquid, and especially when the nearest liquid spot market could be thousands of kilometers away, which then involves extra transport costs for the buyer.

Alternatively, if the spot market price is less than the forward contract price, the buyer pays the value difference to the seller, but with additional logistical and unwinding cost allowances.²⁸ The time inconvenience, administration, opportunity costs, and repurchasing possibly with a higher freight cost may necessitate a lower payment to the defaulting seller.

There are no circumstances whereby a physical contract default can be automatically referred to as a washout, because there are legal settlement obligations by both parties to the contract before closure. There have been instances when buyers demand payout from sellers when spot market prices rise, yet claim contract 'wash-out' when spot market prices fall with no cash settlement or cost disclosures to the seller.²⁹

Buy-in arrangements. As food supply chains become more sophisticated and less commoditized, the possibility of merely buying in commodity and delivering it against a supply contract is diminishing. Historically, if the original seller could not deliver the specified commodity on time, product could be brought from another seller and delivered against the contract.³⁰ The problem is waiting until harvest time and then competing with other buyers bidding prices higher.

The temptation for sellers in a forward contract to buy in product and deliver it against contract only exists if spot market prices are lower than the forward contract price, which is only likely in surplus conditions. If the spot market price is higher than the forward contract price, which is likely under shortage conditions, then buying in from another seller at the higher price in another region to enable delivery against the lower priced local forward contract might be prohibitive for many sellers because of cash flow, working capital, and logistical constraints.

Under quality control and internationally biocertified specifications, the origin of the seller today is of increasing concern to the buyer.³¹ If the original seller cannot deliver the specified commodity, another potential seller could be prevented from delivering against the contract because of quality procedural specifications or biocertification, regardless of product shortage conditions.

A supply chain problem occurs when the defaulting seller purchases old crop from noncommercial commingled sources that include local on-farm product or speculative warehoused stocks with uncertain old crop quality, which might decrease the shelf life of final manufactured products. Commingling or blending can destroy product segregation and identity preservation, which prevents origin tracing and this can increase biofood insecurity.³² This seller opportunism can undermine the integrity of the supply chain system. The government cannot be expected to rectify the quality image that the supply chain participants have themselves damaged. Imports may be the only solution, other than to temporarily cease operations to avoid the risk of losing quality accreditation.

Roll-over allowances. A roll-over in the context of physical, deliverable forward contracts refers to a time extension for the deliverability of physical product against a contract, agreed upon subsequently by both parties unless otherwise stated in the original contractual terms and conditions. It is a time extension of an existing physical deliverable contract, with the seller remaining obligated to the original contractual terms and conditions.

Historically, roll-overs have been allowed by some merchants when farmers could not physically deliver against a deliverable forward contract in one year, but might be expected to be able to deliver in a subsequent year. Roll-overs cannot apply for end users wanting product continuity. The situation only arises in a potential seller default situation, and usually the roll-over is confined to the next delivery season, with the hope that any drought situation will only be of 12 months duration. Credit risk for the farmer and business risk for the merchant greatly increase if the drought is prolonged and additional roll-overs are permitted. Enforcing early short-term pain is often better than incurring a subsequent large pain.

There is no obligation for a merchant to be forced into a roll-over of a physical, deliverable forward contract just because of seller delivery default. The conditions permissible for a roll-over should ideally be included in the original contracts terms, otherwise the buyer has full discretion over whether to allow or reject a roll-over once the potential for delivery default arises.

Roll-overs and dual-year delivery contracts³³ alter market position for the merchant who usually is without longer term back-to-back integration. Whereas the merchant thought there was a long or neutral position, they now may be short again. The willingness to roll-over in a shortage market with a higher probability of scarce product, rising prices, and increased

credit risk needs to be tempered with product availability and falling prices in a surplus market. Much depends on net positions and hedging policies.

Product substitution. There might be occasions in supply default situations when the buyer agrees to accept another product that was not part of the original forward contract agreement. Sometimes it is often better to accept something rather than nothing if there is a potential for bankruptcy. Either party might suggest a substitute product transfer in mediation, but it is the right of the nondefaulting party to accept or reject product substitution.³⁴

Product substitution is more likely to occur with organizations specialized in countertrade or in animal feed industries wherever the substitution of grains, oilseed meal, pulses, or even hay might be acceptable. It is unlikely to occur for end users who buy a specific product that has no close substitutes.

Other default considerations

End users have the financial responsibility to investors and shareholders to locate wherever supply chain security is maximized at lowest transaction cost.³⁵ Those who are dependent on agricultural supply inputs also have the dilemma of deciding the method of product accumulation. End users in deregulated supply chains will generally cluster wherever resource availability leads to product security and avoid regions with high default risk.³⁶

More drought tolerant dual-purpose plant varieties might reduce forward contract default in some marginal production regions. The problem is that food and fibre supply chain contracts are generally short term, while product research and development is relatively long term. Alignment of long term plant breeding objectives to short term dynamic consumer tastes and technological changes in product manufacturing is low, particularly when consumers reject quicker genetic modification methods.

It might be possible to stagger planting times and adopt agronomic tactics that may lead to reduced production risk and lower the risk of contract delivery default.³⁷ However, the potential for such decision making is limited by dominating factors such as weather, with the probability of delivery default for a rainfall-dependent farmer increasing with the marginality of the region. If the farmer has irrigation, then the biological certainty of product is improved.

Selling tactics for a farmer could include starting with a low ratio of forward contracting when the production risk is high, and only increasing the amount forward contracted when production is more certain.³⁸ Some

farmers might only forward contract the quantity required to cover costs of production, but even this is no surety that sufficient production will meet contract delivery requirements in a drought year. There needs to be some production certainty before forward contracting can commence.

Supply chain risk from an end user perspective is highest with direct farmer contracts. An alternative for end users is to contract with a merchant to accumulate specific product, and who is then made responsible for supply default risks and costs. Accumulation merchants can spread their supply chain risk with forward contracts over a range of farmers at different times and localities to minimize the risk of shortfalls at delivery time. Also, they might have other farmers who are on-call to deliver if and when delivery default does occur. A fall back onto imports may be the only solution to product security for end users under drought and hoarding conditions, on the presumption that imports are permitted and cost-effective.

Market position with default

Market position is reversed by contract default, which makes daily valuation important. A farmer who was initially long becomes short in a contract default. Alternatively, the merchant or end user who was initially short becomes long in a contract default.

When a farmer who is initially long signs a forward contract to deliver product at some future time, their market position becomes neutral for the quantity forward sold. However, if the contract delivery is defaulted upon, the farmer reverts to short position. Therefore, the default position for a farmer is short.

Initially long → Neutral in a forward contract → Defaults to a short position

Alternatively, when an initially short merchant or end user signs a forward contract to accept product delivery at some future time, they become neutral for the quantity forward purchased. However, if the contract delivery is defaulted upon, the merchant or end user reverts to long position. Therefore, the default position for anyone who was initially short is now a long position.

Initially short → Neutral in a forward contract → Defaults to a long position

The default position determines both the valuation of the forward contract and the subsequent cash settlement debits and credits.

Valuation of market position

Any long or short market position creates market exposure and a risk of loss in the physical market. However, any market derived from the physical market, such as a futures, options, or a private over-the-counter market will reflect the default market positions. Derived markets are essentially default markets with daily margin settlement. Regardless of whether there is a gain or a loss resulting from the market position, adequate accounting procedures should value the exposure daily, based on the quantity involved.

Without the formal daily clearing mechanism of a futures market, physical forward contract settlement relies on the legal obligations of the seller and buyer under contract law at the maturity date. The seller of a forward contract is obliged to physically deliver the product on the settlement date, and the buyer is obligated to accept delivery and make payment. If these obligations cannot be fulfilled, one alternative method of settlement is the cash transfer of the margin difference between the forward contract price and the current market spot price. Therefore, the major difference between valuing a futures contract and a physical forward contract lies in the time period before either delivery or cash settlement occurs, and therein lays the credit risk in a forward contract.³⁹

Credit risk for the buyer measures the risk that a seller will not deliver the physical product or cannot make cash settlement under default. In contrast, credit risk for the seller measures the risk that a buyer will not pay despite physical delivery having occurred, or not making adequate cash settlement under default. The credit risk associated with physical forward contracts remains high, unless there is periodic cash settlement between the buyer and seller.

Whilst it is not mandatory for the daily valuation and settlement of market position margins for physical forward contracts, the risk of any market position should be accounted for through daily valuation because of the risk of contract default. The valuation of these default positions is by 'marking to market'.⁴⁰ A marked-to-market value is determined by the difference between the current market spot price and the forward contract price adjusted by the time value of money.

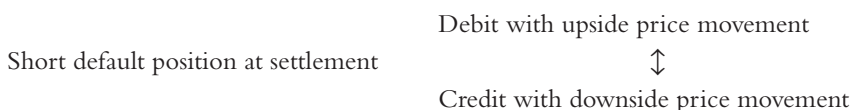
From an accountancy and audit perspective, the product value of a contract should be recorded in the balance sheet, whereas daily margin variations should be recorded in the profit and loss statement. This applies for both physical forward contracts and for futures contracts. Transfer of the ownership of the product or asset usually occurs as soon as the forward contract is signed, and not when delivery occurs. A futures contract becomes a standard forward contract within the delivery period, therefore the asset

value relating to either forward or futures contracts needs to be recorded in the balance sheet.

Spot market prices and the forward market price do not align because of the time value of money. Therefore, under international accountancy standards, either the forward price needs to be discounted to present value,⁴¹ or the present value of the spot market price needs to be compounded to the future value.⁴² The relevant interest rate becomes important in determining the time value of money. However, the more regular that margin settlement occurs between the buyer and seller of a physical forward contract to minimize credit risk, the lesser is the importance of time value and the more the forward contract approaches a futures contract.

Short default position and valuation

A physical seller enters into a physical forward contract with an initial long position and is offset by a physical buyer with a short position, and thus becomes neutral for that quantity to be delivered at some future time. However, if delivery default occurs on the settlement date, then from the perspective of the original seller, the forward contract is valued based on the short default position.



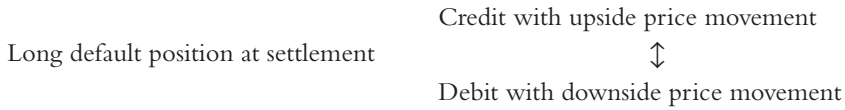
Cash settlement for the physical seller with a short default position would result in a debit if spot market price is above the time-adjusted forward contract price, and a credit if spot market price falls below the time-adjusted forward contract price.

However, there may be direct and indirect costs incurred by the buyer due to the defaulting of the physical delivery, which need to be justifiable and proven to the seller. Therefore, cash settlement payment by the buyer to the seller might be less than the value of the forward contract.

Long default position and valuation

A physical buyer enters into a physical forward contract with an initial short position and is offset by a physical seller with a long position, and thus becomes neutral for that quantity to be delivered at some future time. However, if delivery default occurs on the settlement date, then from the

perspective of the original buyer, the forward contract is valued based on the long default position.



Cash settlement for the buyer would result in a credit if spot market price is above the time-adjusted forward contract price, and a debit if spot market price falls below the time-adjusted forward contract price, both of which could be adjusted by disclosure of costs associated with the default.

Circle of trades

A circle of trades is defined as a series of forward contracts between intermediaries in the supply chain which have the same product origination. They usually are integrative supply chain linkages from the farmer to the end user, which may form the foundation of commercial trade markets. One integrative supply agreement is likely to trigger many back-to-back transactions in position risk neutralization.

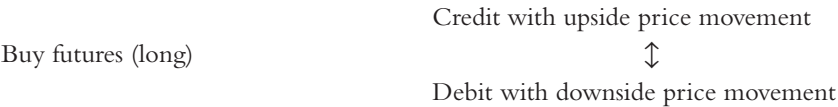
Modern sophisticated global food supply chains and commercial trade markets can be very complex and can be based on contractual product flow from farmers to small- to large-sized merchants, and usually continue through the chain to several manufacturers, wholesalers, distributors and retailers. Fibre-based supply chains include growers, ginners, spinners, weavers, garment manufacturers, wholesalers, and retailers. Specialized skills and the need for product transformation can determine the integration of the supply chain.

If the original physical forward contract is defaulted upon, then this will necessitate the complete unwinding of all contracts in the circle causing much supply chain disruption, mediation, and sometimes independent industry arbitration and legal proceedings.⁴³ Each segment of the circle will require separate negotiation and usually cash settlement between the two relevant parties. Contract roll-overs are likely to be rejected because other buyers within the circle urgently need product, particularly under shortage conditions.

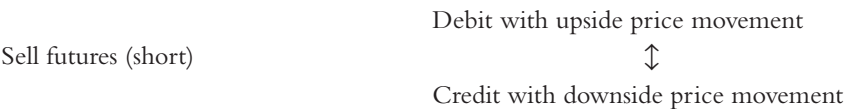
The costs involved with unwinding each position in a circle of trades can be substantial, because of the time inconvenience, administration, opportunity costs, and repurchasing, possibly with a higher freight cost. In contrast, if a merchant has no circle of trades to unwind, there may be few justifiable supply chain costs to deduct in cash settlement default payouts.

Futures contract position and valuation

A futures contract must have a buyer and a seller, similar to a forward contract. The buyer in a futures contract has a long position, with margin credits on the upside, and margin debits on the downside.



Alternatively, a seller in a futures contract has a short position with margin credits on the downside, and margin debits on the upside.



There is no time value of money involved with the valuation of a futures contract because of daily settlement. The margin difference for settlement is the value today less the value the previous day. Daily value for any futures contract month position is calculated by the difference between the current market price and the previous day market price for that particular month multiplied by the number of contracts and the size of each standardized futures contract.

If prices rose, then the value would be credited for the futures contract buyer who is long and debited for the futures contract seller who is short. Alternatively, if prices fell, then the value would be debited for the futures contract buyer who is long and credited for the futures contract seller who is short.

Table 4.1 is an example of a futures trading account over an eight day period. The initial margin is a performance bond that is frozen in the trading account when futures positions are opened and then released when the positions are exited. On the assumption of an initial margin of \$3000 per contract, a price on Day 1 of \$600 per tonne, a brokerage fee of \$50 per contract, a contract size of 50 tonne, and an initial trading account balance of \$150,000, Table 4.1 might be indicative of a futures trading account given daily price movement. Trading losses were incurred on Days 3, 4, and 5. There was a margin call on Day 2 of \$20,000, and another on Day 4 of \$10,000 to maintain the trading account balance at approximately 75 percent of its initial account balance. Roundturing is the notification to the futures broker to exit existing futures contracts and not to establish new

TABLE 4.1 Daily futures trading account

Day	Market position	Market price	Initial margin	Daily margin variation (value)	Brokerage (\$25 per side)	Margin calls	Trading account
1	Buy 10 July contracts	\$600	-\$30,000		10 × \$25 = \$250		\$150,000
2	Buy 5 July contracts	\$610	-\$15,000	+\$10 × 10 × 50 = \$5000	5 × \$25 = \$125	\$20,000	\$119,750
3		\$590		-\$20 × 15 × 50 = \$15000			\$129,625
4		\$580		-\$10 × 15 × 50 = \$7500		\$10,000	\$114,625
5	R Sell 5 July contracts	\$570	+\$15,000	-\$10 × 15 × 50 = \$7500	5 × \$25 = \$125		\$117,125
6		\$590		+\$20 × 10 × 50 = \$10000			\$124,500
7	R Sell 5 July contracts	\$600	+\$15,000	+\$10 × 10 × 50 = \$5000	5 × \$25 = \$125		\$134,500
8	R Sell 5 July contracts	\$610	+\$15,000	+\$10 × 5 × 50 = \$2500	5 × \$25 = \$125		\$154,375
							\$171,750

R - Roundturning (exiting) of existing contracts

Source: John Williams, 2013

positions, which occurred on days 5, 7, and 8. There was high leverage in the futures account transactions in that for a brokerage fee of \$50 per contract, a trader could trade 50 tonne of product with an approximate value of \$30,000.

Clearing house mechanism

One of the main reasons for standardizing futures contracts is to simplify the daily margin settlement procedures through an international clearing house mechanism, which may be just dedicated computed terminals at several international banks. Futures brokers must be aligned to a particular clearing member bank which then undertakes the execution and daily clearing, settlement, and valuation of futures contracts.

Another reason for the standardization of contracts is novation, which is the initial linking of the buyer with a seller, then delinking whereby the clearing house takes the opposite position to each party, and then when one of the original parties wants to exit there is a relinking with another party who also wishes to exit. This other exiting trader is most probably not the same trader who entered the initial transaction. The linking, delinking, and relinking process provides ease of entry and exit in a futures market, thereby aiding liquidity and reducing the bid: offer spread in transaction costs.

Table 4.2 provides an example of the mechanism of a futures contract clearing house. The net profit and loss has been depicted rather than daily settlement margins for the sake of simplicity. In reality, A and B would have incurred daily margin settlements on Day 2 and Day 3, whereas C and D would have incurred daily margin settlements on Day 3.

TABLE 4.2 Futures clearing house mechanism

	<i>Market price</i>	<i>Seller</i>	<i>Net profit/loss</i>	<i>Buyer</i>	<i>Net profit/loss</i>	<i>Volume of contracts traded</i>	<i>Open contract positions</i>
Day 1	\$400	A		B		1	1
Day 2	\$500	C		D		1	2
Day 3	\$300	B	– \$100	C	+ \$200	1	1
Delivery period		D	– \$500	A	+ \$400		0
Contract maturation			– \$600		+ \$600		0

Source: John Williams, 2013

Seller A was linked to Buyer B on Day 1 at a price of \$400, thereby creating one contract as represented by the open contract position. On Day 2, Seller C was linked to Buyer D at a price of \$500, thereby creating an additional contract as represented by the open contract position of two contracts.

Two traders exited on Day 3, with novation of the clearing mechanism linking B who now wishes to exit with a sell position at \$300, with C who wishes to exit with a buy position at \$300. Open contract position decreases from two contracts to one contract. Trader B had a net loss of \$100 while trader C had a net gain of \$200.

If Day 4 is the first day of delivery of the contract, then there is one contract with two opposite positions still open, while the clearing house has incurred a loss of \$100. Buyer D now has to accept delivery against the contract and pay \$500 to the clearing house, while Seller A has to deliver against the contract and receives only \$400 from the clearing house. There are now no open positions, while the clearing house has balanced its debits and credits. Any clearing house expenses are recouped through the client brokerage fee.

5

FUTURES HEDGING AND EFFECTIVENESS

Hedging is the process of offsetting an initial long or short market position with an opposite market position in a parallel market.¹ There can be no hedging a neutral position. Any long or short market position not completely offset will result in speculation, either in the physical market through a partial hedge or through overexposure in the parallel market. Initial market positions that may be hedged include price, currency, and interest rates.

The effectiveness of the hedge is determined either by the physical deliverability against the hedge or the parallelism of the offsetting price as reflected through basis movement. Parallel markets that can be used for hedging include futures and their associated options markets. Private markets that involve forward contracts such as commercial trade markets and some bank markets are generally not classified as hedging.

Physical hedging requires correctly recognizing the initial physical market position and then being able² and willing³ to offset that position risk within the limits of risk trade-offs such as speculative risk and transaction costs. Hedging with either futures or options contracts through a futures market may be more common than forward contracting in regions of high production risk because of the ability to enter and exit the hedge through novation without the need for physical delivery, and by being able to dynamically adjust the size of the hedge.⁴

In contrast to physical hedging, a synthetic hedge usually offsets an initial futures market position with an options position. Whereas this chapter will be confined to physical hedging using futures contracts, Chapter Six will focus on hedging using options contracts.

Prerequisites for hedging

A liquid forward futures market that is approximately parallel to the physical market is required to offset position risk. The parallelism between the physical market price and the forward futures market price is measured through basis movement.⁵ Relevance of the futures market to the underlying local commercial trade market is important to basis risk,⁶ but this relevance is likely to diminish for more distant or international hedges. The ability to effectively hedge diminishes as basis and currency risk increases.⁷

Despite much rhetoric to the contrary, the sole function of modern agricultural futures markets apart from price transparency is to offset price risk in hedging.⁸ Their former role of enabling the transfer of forward contracts before delivery to avoid default has been surpassed. Only a very small fraction of total agricultural futures contracts are now delivered against in the delivery period. Despite this low delivery percentage, deliverability and parallelism are important hedge prerequisites to maximize hedge relevancy and to minimize basis risk. A deliverable futures contract must be allowed to become a normal commercial fixed price forward contract in the delivery period.⁹

Adequate futures market price signals that guide hedging decisions require supply chain efficiency with minimum supply chain distortions and price controls.¹⁰ There is a need for agricultural futures markets that have effectiveness as measured by parallelism to the underlying commercial trade market,¹¹ relevancy as reflected through minimum basis volatility,¹² and liquidity that provides low transaction cost.¹³ There is also a need for balance between hedgers and speculators to maximize relevancy but still have market liquidity. Speculators in a futures market are required to add liquidity and thus reduce the bid: offer spread transaction cost.¹⁴

Hedged positions

A physical hedge requires the physical market position to be offset by a futures market position.¹⁵ A long physical market position is offset by a short futures market position and is known as a short hedge, whereas a short physical market position is offset by a long futures market position and is known as a long hedge.

Physical long with downside risk offset by short hedge with sell futures = neutral

Physical short with upside risk offset by long hedge with buy futures = neutral

The hedged positions in a futures market are the default positions of a physical deliverable forward contract. An initial long physical position

defaults to a short position in a deliverable forward contract, which is the sell position in a futures contract. In contrast, an initial short physical position defaults to a long position in a deliverable forward contract, which is the buy position in a futures contract.

If the initial market position is accidentally or deliberately repeated in the futures market, causing a doubling of market positions, then this situation is referred to as a 'Texas hedge'. It is double speculation which results in either large profits or large losses. If the initial physical is long, then adding to the market position with buy futures is a 'Texas hedge' and is not offset. Similarly, if the initial physical is short, then adding to the market position with sell futures is a 'Texas hedge' and is not offset.

Hedging objectives and tactics

Hedging objectives can vary from loss minimization, price averaging, covering costs of production, basis trading, or protection of profit margins for merchants and end users. The multiple purposes of hedging therefore require a clear focus by management on what is the objective, otherwise trading activity in a futures market can easily revert to speculation.

Profit maximization cannot be an objective of futures hedging because of opportunities foregone through margin transaction costs. However, there is a danger of excessive optimism that could lead to futures market speculation. Having taken a physical market position, there could be a temptation to increase this market exposure unnecessarily in the futures market. Knowledge of hedging risks should lead to tactical considerations that remove emotions from decision making.¹⁶

Hedging outcomes need to be evaluated against physical speculation. Whilst hedging has its costs and risks, physical speculators have the disadvantage of frequently missing market peaks and troughs.¹⁷ The biggest advantage for short hedgers is that positive price skewness favours them most of the time, which then should be reflected in hedging objectives. Also, positive skewness results in long hedgers not being required to hedge for most of the time. Aligning the hedge to price skewness and trends in contango or backwardation is therefore important when establishing objectives and tactics.

Hedging tactics include consideration of the hedge ratio. The hedge ratio is the percentage of total quantity to be hedged, and is expressed by the quantity to be hedged divided by the total quantity. Production and supply uncertainty are highly likely to decrease the hedge ratio for a farmer.¹⁸ This contrasts to a merchant or end user who may maximize the hedge ratio because of known inventory requirements.¹⁹

It can be argued that because futures markets are derived from commercial trade markets and were never designed for domestic farmers who are not in close proximity, or international farmers whose old and new crop dates are completely different, farmers should consider hedging to be very opportunistic with hedge ratios kept low, particularly when combined with currency and production risk.²⁰ Farmers might start with low hedge ratios after planting and then increase the ratio as production becomes more certain in each growing phase.²¹

Types of hedges

There can be a number of different commercial situations and timing aspects which can differentiate hedging types and methods.²² Preharvest hedging has quite different characteristics to postharvest hedging.

Anticipatory hedge. Preharvest hedging is based on the anticipation of producing a product at some future time.²³ Farmers who are producing agricultural output are long, regardless of not having the final product. They have downside price risk from the moment of the first expenditure on production, which could be for fuel, seed, or fertilizer. An anticipatory hedge would offset that physical long position with a short futures position, but the trade-off is production uncertainty and speculative risk.²⁴

Alternatively, a merchant or end user with a forward selling commitment anticipates a need to buy product to meet the future need.²⁵ The short position with upside price risk can be offset in an anticipatory hedge with a long futures position. There is very little trade-off in this situation and less risk compared to a farmer because of the known quantity throughput.

Storage hedge. A farmer or merchant who owns unsold physical product is long with downside price risk and could hedge with a short futures position.²⁶ However, the rationale of a storage hedge for a farmer is questionable, because if the aim of the storage is to maximize price potential, then futures hedging defeats the objective. Downside price risk can be managed by immediately selling the physical product rather than hedging.²⁷

An end user could purchase in excess of immediate needs and be long with downside price risk because of the current availability of the input and a risk of future shortages. However, if prices subsequently fall and competitors buy in input supplies much cheaper, then they could undercut the end user with lower output prices. There can be a problem when end users become speculative merchants.²⁸

One advantage for a farmer or merchant to hedge unsold stored product is speculating on basis through basis trading. There is the hope that the futures price in the hedge will fall further relative to the movement in local physical prices. A positive basis movement with futures prices falling and physical prices rising will be profitable in a storage hedge, whereas a negative basis movement with futures prices rising relative to a fall in the physical price will result in financial losses for a storage hedge.²⁹

Currency hedge. An exporter can be long by holding US dollars but short because of the need for domestic currency. The exporter could establish a long futures position in domestic currency to hedge the exposure. Alternatively, an importer can be short because of the need for US dollars but long by holding domestic currency. The importer could establish a short futures position in domestic currency to hedge the exposure.

Cross hedge. Attempting to offset the physical price risk of one product with the futures price movement of another product can be referred to as a cross hedge, such as grain sorghum prices against corn futures prices when there is no grain sorghum futures market.³⁰ Cross hedging depends on some parallelism and minimum basis and currency volatility between the physical and futures prices during the hedge, otherwise daily margin losses could be excessive.

Roll-over hedging. Rolling over a futures hedge position would require re-establishing the futures hedge in a distant month once the original hedge position in the near month has matured.³¹ Prolonging a hedge would be unlikely if there were high risks involving production, basis, or currency, or for farmers when prices reached historical lows. Farmers might be more willing to roll over a short hedge in bearish contango markets or whenever backwardation is decreasing or carry increasing. Alternatively, merchants and end users might be more willing to roll over long hedges in bullish backwardation markets or whenever carry is decreasing or backwardation increasing.

Exchange for Physical or Against Actuals. A sugar mill may have been long with the accumulated storage of raw sugar, and then hedged with sell futures for downside price protection. If that raw sugar was sold to a sugar refiner, then the sugar mill would then be neutral for physical raw sugar but left holding a speculative sell futures position. In contrast, the sugar refinery

may have gone from a neutral physical position to a new long position and requires sell futures for downside price protection. As part of the physical sale–purchase transaction, the sell futures contracts are transferred by the sugar miller to the sugar refiner. This transfer can either be known as Exchange for Physical (EFP) or Against Actual (AA), but the futures broker and clearing house need to be notified of the transfer.

Merchant facilitated hedging. Merchants are sometimes permitted to offer futures, currency, and basis flexibility to farmers and end users, but it is conditional on an underlying physical transaction occurring through a forward contract. The variation in merchant pricing products is diverse due to different futures price, basis, and currency combinations. There can be basis contracts that simply lock in basis and defer futures price and currency. Alternatively, either currency or futures price, or both, can be locked in without basis. Whenever all three components are locked in, then price reverts to a ‘flat price’.

Merchant pricing flexibility cannot occur with back-to-back commercial trade commitments as it is not possible for a merchant to forward sell without knowing the basis in a purchase price. Because there is no back-to-back trade, the merchant will have a long position after signing a contract with a farmer, or a short position after signing a contract with an end user, which creates a need for hedging. The advantage for a merchant in offering contract pricing flexibility is that hedging costs can be passed onto the farmer or end user through price discounts or premiums.

Hedge-to-Arrive (HTAs) or Futures First deliverable forward contracts enable farmers to lock in futures price and currency with the merchant whilst deferring basis. The merchant needs to establish a short futures hedge and a long currency hedge to manage risk. If basis is not locked in by the farmer prior to delivery, then it is set by the merchant on the day of delivery. The benefit or risk to the farmer is that basis can be traded for potential favourable movement. However, the merchant foregoes basis trading, as well as incurring any margin losses with the futures and currency hedge positions if any physical delivery default eventuates, as occurred in 1995 and 1996 in the USA³² and in Australia during 2002, 2006, and 2007.

Requirements for futures hedging

An individual or organization can establish a futures trading account through a futures broker with an international clearing member bank. If authority is provided under a contractual agreement, a futures broker can be made

responsible for a discretionary managed hedge account for a client. Alternatively, the futures trading account can be administered through a new or existing working capital bank account, with the bank management made responsible for the market position margins, account clearing operations, and the currency transactions. Whenever the bank formalizes this procedure into a product disclosure statement, the outcome usually is an over-the-counter product.

Opening a futures trading account usually includes client acknowledgement of the risk involved with financial losses. Each individual client is then made responsible for the daily margin settlement through their futures trading account. The client must have enough money in the trading account, otherwise any resulting exposed positions will be closed out immediately, regardless of whether the client is hedging or speculating. Recoupment of futures market losses are the primary responsibility of the clearing member and the futures broker, so they are unlikely to underwrite the losses of an errant client.

The futures trading account will reflect open and closed positions, daily price movement and margin settlements, brokerage, margin call deposits, position valuations, and daily account balances. Futures trading accounts are based on the daily margin settlement relating to price movement, which is the difference between the position valuation today and the previous valuation and settlement. If the futures trading account balance falls below 75 percent of its initial account balance, then a margin call or maintenance margin is required to top up the account, usually within 24 hours, otherwise the position can be closed by the futures broker.

If daily losses occur, a client with an individual trading account might be prevented from exiting because of market illiquidity. The futures exchange therefore imposes daily price movement limits to ensure that losses can be covered by daily margin settlements. Daily price movement limits must equate to the initial margin, which is a performance bond initially frozen in the client's trading account to cover single day losses but released when the market position is closed. Some futures brokers may require three times the initial margin for each contract in the futures trading account before opening a position, just in case illiquidity prevents early exiting of the position when losses occur.

International clients incur daily margin settlements in the currency denomination of the futures exchange, which could result in daily currency conversion transaction costs. This is on top of the currency exposure of the underlying physical market position. One solution is to operate the futures trading account in the currency denomination of the futures market, and to

hedge the underlying physical market currency exposure at the same time as the price hedge. However, general unwillingness for clients to undertake such dual currency transactions creates opportunities for banks to offer over-the-counter pricing products.

Good leverage usually results from futures hedging because for a US \$50 brokerage fee per contract, a client can trade 50–150 tonne of product with values up to US \$50,000 or more. Average brokerage fees can be less than US \$1 per tonne, but this depends on the futures contract size, the number of contracts transacted, and the client service provided.

Futures contract specifications are specific for each futures exchange, and this will influence hedging decisions. The number of futures contracts selected will depend on the contract size, while the availability and liquidity of forward futures months will determine which contract month will be selected. Futures contract sizes usually vary from 20 tonne to 150 tonne, whereas there usually are four to six different forward months for selection each year.

Futures hedging mechanism

Four examples of hedging and its effectiveness are provided for farmer and end user market positions with favourable and unfavourable basis movement. The quantity to be hedged is assumed to be 1000 tonne with time alignment between price exposure and the hedge, the standardized size of the futures contract being 50 tonne, and brokerage is ignored.

The first hedge example in Table 5.1 is a farmer establishing an anticipatory short hedge with falling prices after planting has occurred. The farmer expects to produce at least 1000 tonne with price risk exposure on the downside. However, basis movement during the duration of the hedge is unfavourable.

In Table 5.1, the farmer lost \$100 per tonne between planting and harvesting time, but gained \$80 per tonne through the short futures hedge. When compared to no hedge that would have resulted in \$200 per tonne, the short hedge was effective in that the farmer realized \$280 per tonne. However, full effectiveness of the hedge was limited by \$20 per tonne unfavourable basis movement (Figure 5.1).

In Figure 5.1, the physical price fell from \$300 to \$200 per tonne, while the futures price fell from \$330 to \$250 per tonne. There was cash under divergence in downward basis movement. The losses in the physical market were not completely offset by the gains in the futures market, with the difference of \$20 per tonne being explained as unfavourable basis movement.

TABLE 5.1 Farmer with an anticipatory short hedge and unfavourable basis

Time	Physical Market	Futures Market	Basis
Planting	Intention: To sell 1000 tonne of commodity at harvest. Forward price: \$300/tonne★ Risk: price will fall	Farmer takes out 20 (sell) futures contracts at \$330/tonne★★ Position value: $\$330 \times 50 \times 20 = \$330,000$	\$30/tonne cash under
Harvest	Farmer sells 1000 tonne of commodity at \$200/tonne Value: $1000 \times \$200 = \$200,000$	Farmer roundturns with 20 (buy) futures contracts at \$250/tonne. Position value: $\$250 \times 50 \times 20 = \$250,000$	\$50/tonne cash under
Hedge outcome	Physical ‘loss’ \$100/tonne Value ‘loss’ = \$100,000 Actual price + futures gain \$200/tonne + \$80/tonne Realized price = \$280/tonne Value: $1000 \text{ tonne} \times \$280 = \$280,000$	Futures gain \$80/tonne Value gain = \$80,000	\$20/tonne

★ Physical forward price

★★ Futures forward price



FIGURE 5.1 Unfavourable basis movement for farmer with an anticipatory short hedge

TABLE 5.2 Farmer with an anticipatory short hedge and favourable basis

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>	<i>Basis</i>
Planting	Intention: To sell 1000 tonne of commodity at harvest. Forward price: \$300/tonne ★ Risk: price will fall	Farmer takes out 20 (sell) futures contracts at \$330/tonne ★★ Position value: $\$330 \times 50 \times 20 = \$330,000$	\$30/tonne cash under
Harvest	Farmer sells 1000 tonne of commodity at \$400/tonne Value: $1000 \times \$400 = \$400,000$	Farmer roundturns with 20 (buy) futures contracts at \$390/tonne. Position value: $\$390 \times 50 \times 20 = \$390,000$	\$10/tonne cash over
Hedge outcome	Physical 'gain' \$100/tonne Value 'gain' = \$100,000 Actual price – futures loss \$400/tonne – \$60/tonne Realized price = \$340/tonne Value: $1000 \text{ tonne} \times \$340 = \$340,000$	Futures loss \$60/tonne Value loss = \$60,000	\$40/tonne
★ Physical forward price		★★ Futures forward price	

The second hedge example in Table 5.2 is a farmer establishing an anticipatory short hedge with prices rising after planting has occurred. Again, the farmer expects to produce at least 1000 tonne with price risk exposure on the downside. However, basis movement during the duration of the hedge this time is favourable.

In Table 5.2, the farmer gained \$100 per tonne between planting and harvest time, but lost \$60 per tonne through the short futures hedge. When compared to no hedge that would have resulted in \$400 per tonne, the short hedge was less effective in that the farmer realized only \$340 per tonne, and even that was achieved through favourable basis movement of \$40 per tonne. In so far as the short hedge provided downside price protection, the effectiveness of the hedge was apparent, but it was limited by an inability to opportunistically capture the upside price movement. An options hedge that can provide both downside protection as well as upside gain will be discussed in Chapter Six.

In Figure 5.2, the physical price rose from \$300 to \$400 per tonne, while the futures price rose from \$330 to \$390 per tonne. Physical prices increased

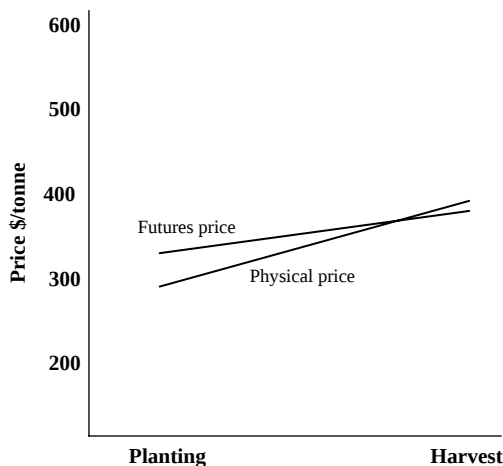


FIGURE 5.2 Favourable basis movement for farmer with an anticipatory short hedge

from initially being under the futures price to be finally over the futures price. The gains in the physical market were not completely cancelled by the losses in the futures market, with the difference of \$40 per tonne being explained as favourable basis movement. There was an opportunity cost of \$60 per tonne compared to not undertaking a futures hedge.

The third hedge example in Table 5.3 is an end user who is anticipating being short in six months' time and establishes a long hedge with falling prices. The end user needs to buy 1000 tonne with price risk exposure on the upside. However, basis movement during the duration of the hedge is unfavourable.

In Table 5.3, the end user gained \$100 per tonne during the six month duration in the physical market, but lost \$110 per tonne through the long futures hedge. When compared to no hedge that would have resulted in \$400 per tonne, the long hedge was less effective in that the end user had to eventually pay \$510 per tonne, which was worsened by an unfavourable basis movement of \$10 per tonne. In so far as the long hedge provided upside price protection, the effectiveness of the hedge was apparent, but it was limited by an inability to opportunistically capture the downside price movement. An options hedge that can provide both upside protection as well as downside gain will be discussed in Chapter Six.

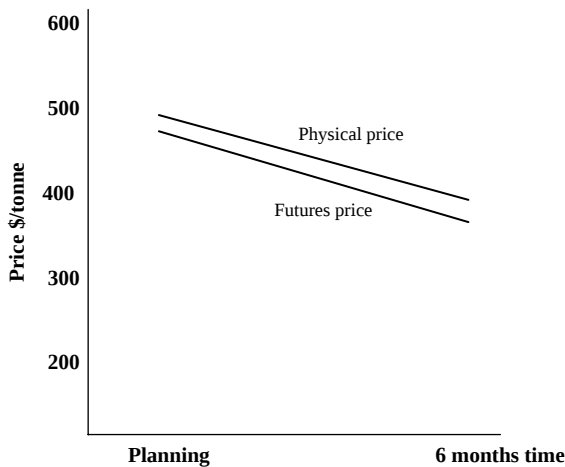
In Figure 5.3, the physical price fell from \$500 to \$400 per tonne, while the futures price decreased from \$480 to \$370 per tonne. There was cash

TABLE 5.3 End user short with an anticipatory long hedge and unfavourable basis

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>	<i>Basis</i>
Planning	Intention: Needs to buy 1000 tonne of commodity in 6 months time. Forward price: \$500/tonne *	End user takes out 20 (buy) futures contracts at \$480/tonne ** Position value: $480 \times 50 = \$480,000$	\$20/tonne cash over
Six months time	Risk: price will rise End user buys 1000 tonne of commodity at \$400/tonne Value: $1000 \times \$400 = \$400,000$	End user roundturns with 20 (sell) futures contracts at \$370/tonne. Position value: $370 \times 50 = \$370,000$	\$30/tonne cash over
Hedge outcome	Physical 'gain' \$100/tonne Value 'gain' = \$100,000 Actual price + futures loss \$400/tonne + \$110/tonne Realized price = \$510/tonne Value: $1000 \text{ tonne} \times \$510 = \$510,000$	Futures loss \$110/tonne Value loss = \$110,000	\$10/tonne

* Physical forward price

** Futures forward price

**FIGURE 5.3** Unfavourable basis movement for end user short with long hedge

over divergence in downward basis movement. The gains in the physical market were more than completely cancelled by the losses in the futures market, with the adverse difference of \$10 per tonne being explained as unfavourable basis movement. There was an opportunity cost of \$110 per tonne compared to not undertaking a futures hedge.

The fourth hedge example in Table 5.4 is a merchant who is anticipating being short in six months' time and establishes a long hedge with rising prices. The merchant needs to buy 1000 tonne with price risk exposure on the upside. Basis movement during the duration of the hedge is favourable.

In Table 5.4, the merchant 'lost' \$100 per tonne during the six month duration in the physical market, but gained \$110 per tonne through the long futures hedge. When compared to no hedge that would have resulted in \$600 per tonne, the long hedge was very effective in that the merchant only had to eventually pay \$490 per tonne, which was assisted by a favourable basis movement of \$10 per tonne. The effectiveness of the hedge was apparent in that the long hedge provided the required upside price protection.

TABLE 5.4 Merchant short with a long hedge and favourable basis

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>	<i>Basis</i>
Planning	Intention: To buy 1000 tonne of commodity in six months time. Forward price: \$500/tonne★ Risk: price will rise	Merchant takes out 20 (buy) futures contracts at \$480/tonne ★★ Position value: $480 \times 50 = \$480,000$	\$20/tonne cash over
Six months time	Merchant buys 1000 tonne of commodity at \$600/tonne Value: $1000 \times \$600 = \$600,000$	Merchant roundturns with 20 (sell) futures contracts at \$590/tonne. Position value: $590 \times 50 = \$590,000$	\$10/tonne cash over
Hedge outcome	Physical 'loss' \$100/tonne Value 'loss' = \$100,000 Actual price – futures gain \$600/tonne – \$110/tonne Realized price = \$490/tonne Value: $1000 \text{ tonne} \times \$490 = \$490,000$	Futures profit \$110/tonne Value gain = \$110,000	\$10/tonne

★ Physical forward price

★★ Futures forward price

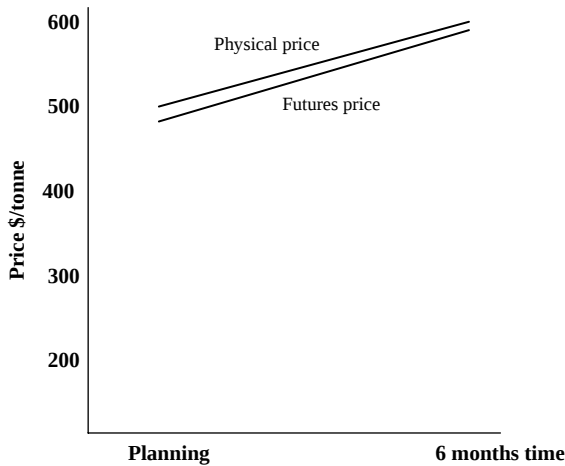


FIGURE 5.4 Favourable basis movement for end user short with long hedge

In Figure 5.4, the physical price rose from \$500 to \$600 per tonne, while the futures price increased from \$480 to \$590 per tonne. There was cash over convergence in upward basis movement. The losses in the physical market were more than completely offset by the gains in the futures market, with the difference of \$10 per tonne being explained as favourable basis movement.

Tactical considerations

Hedging decision making for farmers, merchants, and end users needs to include why, how, when, and how much, after taking into consideration the uncertainty, risks, costs, and trade-offs. It is questionable as to why a farmer would want to hedge at the bottom end of the historical price range, particularly when such a price does not cover costs of production and when there is a high probability of prices rising above the bottom end of the range. Alternatively, an end user might avoid hedging at the top end of the price range especially when the positively skewed probability of price movement is downwards, however, there is a risk that prices could rise even further, beyond the historical price range.

The method of hedging is another important tactical consideration. Opportunity costs can be high with futures hedging because of the inflexibility of the hedged price.³³ This contrasts with options hedging that provides for price flexibility. As well, there is the dual currency dilemma for international futures hedgers through both margin and physical exposure,

which requires evaluation against the positive advantages of over-the-counter pricing products.

Forward price movement in contango or backwardation is an important signal in tactical hedging decision making. Hedging price in an increasing backwardation market for a farmer, or hedging price in an increasing contango market for an end user, might be highly questionable because of unnecessary margin losses. A farmer and long merchant might be more likely to hedge when carry is increasing or backwardation decreasing, whereas a short merchant and end user might be more likely to hedge when carry is decreasing or backwardation increasing. Exiting a hedge can be just as important as entering a hedge.

There is seasonality in production, harvesting, stock holding, and end usage that can create pricing opportunities.³⁴ Merchants can have stock and inventory exposure based on seasonal timing that reflects changing customer demand and product supply.³⁵ There may be a need for hedging in several old crop months as well as new crop months for a merchant.³⁶

The hedge ratio can be linked to both hedging objective and tactics.³⁷ A low hedge ratio for a farmer might indicate highly uncertain yields and marginal production, whereas a high hedge ratio for an end user should indicate far more certainty over throughput demand and supply input requirements.

Benefits of hedging

Hedging risks and costs can be absorbed provided that favourable outcomes occur most of the time. There is a critical threshold for incurring unfavourable outcomes beyond which regret and avoidance become ingrained into the psyche of the potential hedger. The benefits of hedging must be apparent most of the time for regular hedging practice to continue.³⁸

Short hedgers need to profit during price downtrends, while long hedgers need to profit in price up trends, otherwise financial losses associated with risks such as daily margins, basis, and currency overwhelm any hedge objectives.³⁹ The freedom to have hedge positions that are contrary to the prevailing price trend⁴⁰ is generally restricted to options hedging.

The advantages of futures markets such as price transparency, immediacy of transactions, and anonymity need to be kept quite distinct from the benefits of futures hedging. Factors that may attract futures trading may not be the same as those that induce futures hedging.

Improvements in budgeting and cost control might be expected if price is a major variable in business operations and if it can be adequately managed

through hedging. Managing price risk can lead to some farmers perceiving that that can lower their discretionary cost of production, thus keeping costs relatively proportional to price to protect a profit margin.⁴¹ The management of price and the indirect influence over discretionary costs may lead to improved credit facilities.⁴² This may be more applicable to end users and merchants with higher supply chain certainty than a dry-land farmer with greater production uncertainty.⁴³

Futures hedging by merchants and end users can lead to better management of product inventory. The need for input supplies and maximizing the return on warehouse space are often incompatible inventory goals.⁴⁴ Just-in-time input supplies facilitate the allocation of higher value products to the critical minimum warehouse space available. This can induce savings on storage carry costs and increase stock turnaround, but there is upside input price exposure which can be protected through futures hedging.

Basis trading

Futures hedging does not lock in basis unless delivery occurs against the contract. Basis flexibility facilitates basis trading. This contrasts with a physical forward contract that usually locks in basis. Hedging creates an awareness of basis movement as a separate entity to the futures price and currency, which otherwise might not be noticed.

The movement of basis in hedging may be favourable or unfavourable. Merchants are more likely to trade basis movement as one of their components in generating profits. Differences in seasonal timing and new or old crop dates between regions in the northern hemisphere and southern hemisphere create opportunities for basis trading.

Local physical price rises for old crop after harvest in one locality might occur when the futures market is falling due to new crop harvest expectations. Buying physical product at harvest will benefit from the old crop price rises, while the short futures hedge will benefit from new crop price falls. Basis movement will favour the short hedger and be detrimental to the long hedger whenever there is cash under converging basis (Figure 5.5a). However, if the physical old crop price falls further than the fall in the futures market price (Figure 5.5b), this cash under divergent basis movement will be unfavourable to the short hedger.

Alternatively, what is favourable to the short hedger will be unfavourable to the long hedger. Basis movement will favour the long hedger if there is cash under divergence (Figure 5.5b), and be detrimental whenever there is cash under converging basis (Figure 5.5a).

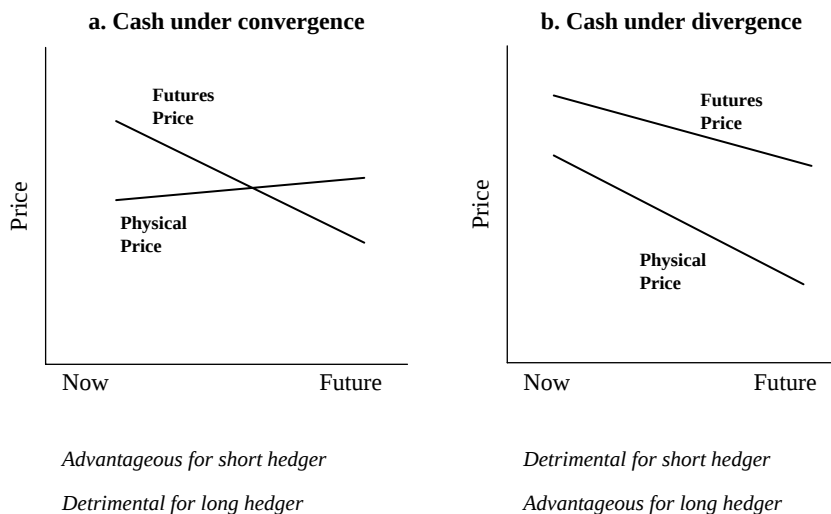


FIGURE 5.5 Cash under basis movement with falling futures prices

In contrast, a cash over basis movement can have the opposite effect. If the physical price is higher than the futures price and falls further than the decrease in the futures price, then this will be detrimental to the short hedger (Figure 5.6a). However, if the futures price falls further than the decrease in the physical price, then this will be advantageous to the short hedger (Figure 5.6b).

Alternatively, what is unfavourable to the short hedger will be favourable to the long hedger. Basis movement will favour the long hedger if there is cash over convergence (Figure 5.6a), and be detrimental whenever there is cash over diverging basis (Figure 5.6b).

When hedging with upward moving futures prices, cash under convergence basis movement will favour the short hedger because the gains through the physical price movement outweigh the losses in the futures market (Figure 5.7a). However, basis movement will be unfavourable to the short hedger whenever there is cash under diverging basis, because the losses on the futures market outweigh the gains on the physical market (Figure 5.7b).

Alternatively, what is unfavourable to the short hedger will be favourable to the long hedger. Basis movement will be detrimental for the long hedger with upward moving futures prices whenever there is cash under converging basis (Figure 5.7a) and be favourable to the long hedger whenever there is cash under diverging basis (Figure 5.7b).

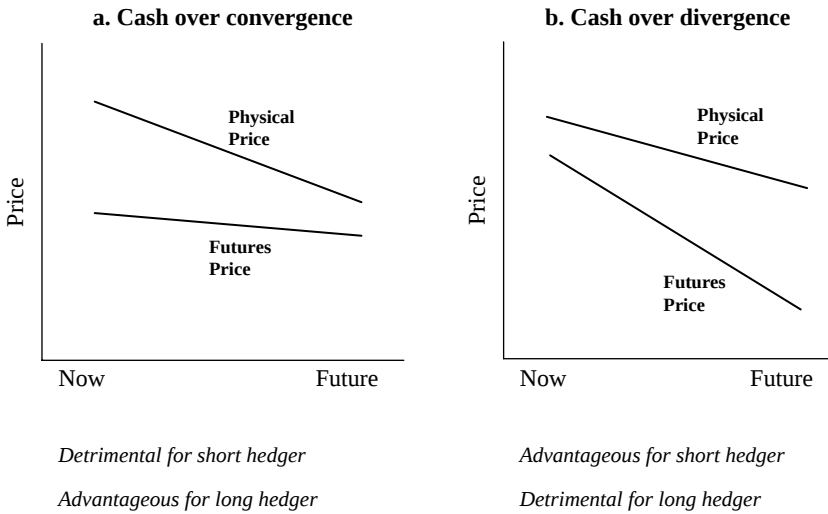


FIGURE 5.6 Cash over basis movement with falling futures prices

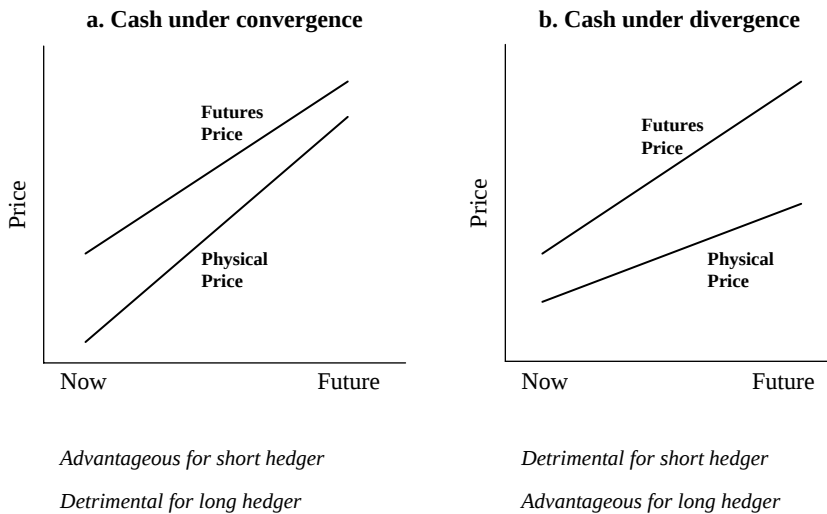


FIGURE 5.7 Cash under basis movement with rising futures prices

When hedging with upward moving futures prices, cash over convergence basis movement will be detrimental to the short hedger because the losses in the futures market outweigh the gains through the physical price movement (Figure 5.8a). However, basis movement will be favourable to the short hedger whenever there is cash over divergent basis because the losses

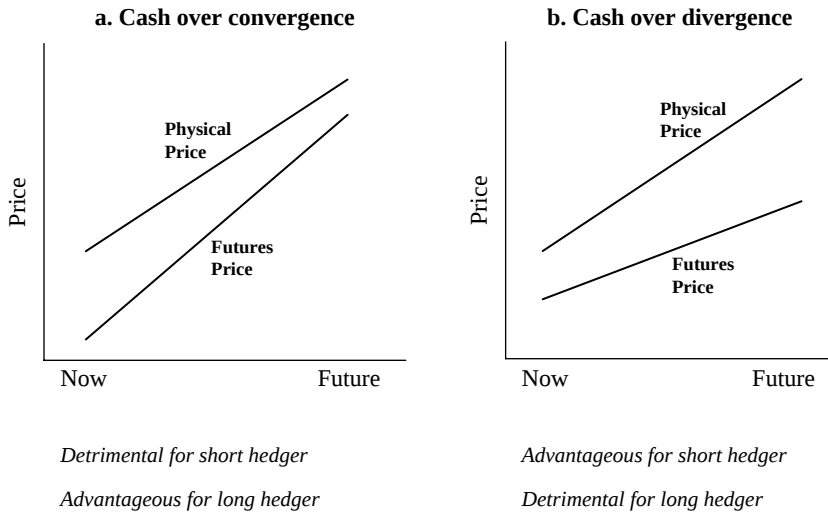


FIGURE 5.8 Cash over basis movement with rising futures prices

on the futures market are outweighed by the gains on the physical market (Figure 5.8b).

Alternatively, what is unfavourable to the short hedger will be favourable to the long hedger. Basis movement will be favourable for the long hedger with upward moving futures prices whenever there is cash over converging basis (Figure 5.8a) and be unfavourable to the long hedger whenever there is cash over diverging basis (Figure 5.8b).

Carry and backwardation considerations

Short hedging in a bearish surplus market would be expected to capture a high forward price relative to the spot price because of the carry component. The question arises as to whether carry will be advantageous or detrimental to the short hedger. Much depends on the duration of the hedge, the contract month in relation to the old and new crop year, and deliverability.⁴⁵

Carry will be captured by a short hedger whenever the contract is delivered against. The futures contract reverts to a forward contract in the delivery period at a price that was locked in when the hedge was initiated. In contrast, any carry advantage in a short hedge becomes problematic if delivery against the contract does not occur because carry should be a dynamic variable.

If contract delivery does not occur, then the hedge-realized price will depend on the roundturned futures market exit price. Distant months in surplus markets should reflect old crop carry or expectations of new crop carry. As the hedged month approaches contract maturity, it might retain its old crop carry component, but it can now be influenced by movements in carry in the distant months. Increasing carry in the distant months should apply downward pressure on nearby month prices, whereas decreasing carry in the distant months should apply upward pressure on nearby month prices.

Spot month prices may or may not have an old crop carry component, as much depends on current surpluses or shortages. However, spot month prices within the half-month delivery period of a futures market are rather meaningless because contracts are being delivered against at earlier initiated prices. The only justification for retaining spot prices for a spot futures month in the delivery period is when there is contract default settlement under exceptional circumstances within the delivery period.

From a short merchant or end user perspective in a long futures hedge, the locked in distant futures month price will be achieved if delivery is accepted against the contract. However, if the hedge is roundturned before the delivery period, then the hedge outcome depends on the movement of backwardation or carry during the duration of the hedge as the distant hedge month approaches the spot month and contract maturity. An increasing bullish shortage supply chain could result in the spot futures price rising and the forward futures price falling either due to decreasing carry or an increasing discount.

Hedging risks and limitations

The problem of modern futures markets is that they are expected to do things that are well beyond the initial intentions and capabilities of their original design. Most were initially established to minimize credit risk in contract default within agricultural commercial trade markets between localized merchants and end users, and their forward market was confined to a local deliverable warehouse market. Futures markets were never designed for farmers,⁴⁶ or for international hedgers who may include statutory authorities, and they were never designed for high basis and currency risk situations.⁴⁷ Markets can hardly fail when it was never the intentions of the original market design.

Basis risk in hedging cannot be avoided except through the original contract design or by delivering the physical product against the contract. Whilst it might be expected that the spot month futures price might approach the

underlying spot commercial trade market price sometime before contract maturity,⁴⁸ this provides little assurance against basis risk for those who cannot physically deliver and need to close out a hedge through roundturning.

Hedging does increase the burden of administration and decision making, which some may perceive as the cost of long-term profitability. Decisions need to be made between risks, costs, trade-offs, and opportunities, while balancing between loss minimization and profit maximization objectives. The evolution from forward contracts to futures hedging to options hedging, and then to over-the-counter products involved attempts to minimize risks when hedging price.

Timing is particularly important in international hedging when basis and currency risk are high and it is impossible to deliver against the futures contract because of transport costs.⁴⁹ Currency risk may not be an issue in the USA but it exists elsewhere.⁵⁰

Commodity price skewness favours short hedging and disadvantages long hedgers. Volatility is desirable⁵¹ because there is a need for periodic price movement to provide short hedging opportunities and profitability for farmers.⁵² However, many farmers perceive higher prices as an opportunity to maximize their income and profit, repay debt and make new farm investments, and believe that hedging limits such opportunities. High price hedging opportunities are often thus thwarted.

The cost of futures hedging is intrinsically linked to transaction costs that include pricing opportunities foregone. Opportunity costs are eliminated whenever a hedge is effective against adverse price movement. However, opportunity costs increase in a futures hedge whenever there is favourable physical price movement which is offset by margin losses in the futures market. The margin losses then become the opportunity cost of a futures hedge.

Low profitable marginal farmers are unlikely to lock in prices when their profitability depends on price maximization and not loss minimization.⁵³ They are unlikely to have sufficient cash flow for initial margins, daily margin settlements, and large cash balances in a futures trading account because of the time value of money and the working capital account opportunities foregone. Managing price might be perceived as prudent credit risk management by bank managers, but if production fails, futures market positions can end with excessive margin exposure and cash flow problems, which then jeopardizes debt repayment.⁵⁴

There is a need for efficiency in both the commercial supply chain and futures market to provide transparent signals for pricing and hedging decision making.⁵⁵ These signals and hedge effectiveness require efficient

linkages between local supply chains and futures markets.⁵⁶ Futures hedging usage decreases if arbitrageurs are unable to make periodic futures market corrections to minimize price distortions.⁵⁷ India is a case example.

The ability to hedge in futures markets assumes that there is sufficient liquidity in the forward futures market to minimize slippage and transaction cost through the bid: offer spread. Forward market liquidity is severely limited on most global agricultural futures exchanges, except those in USA. Illiquidity in local futures markets forces potential hedgers into international hedging that may incur high basis and currency risk.⁵⁸

The attempt to use corn yield futures contracts to remove production risk when hedging price risk has largely failed.⁵⁹ Similar to some other cash settled contracts, the forward market for these weather-dependent derivatives is very unstructured and speculative. If rain was forecasted and everyone was bullish on crop yields, there would be no sellers of yield futures. Alternatively, if no rain was forecasted and everyone was bearish on crop yields, there would be no buyers of yield futures. There are serious liquidity problems with such markets, and any movement is accentuated by the willingness of the market-maker to adjust market outcomes arbitrarily.⁶⁰ Speculating on future weather forecasts should be no basis for a market, regardless of any danger for manipulation and corruption.

6

OPTIONS HEDGING AND PRICE ENHANCEMENT

Options were used by the Phoenicians five and a half thousand years ago to enable choice for merchants to buy or sell products but only if the ship arrived, given tempests, pirates, and war.¹ Buy or sell obligations were therefore only activated if the ship arrived in port. Similarly, Thales in ancient Greece used options to rent olive presses, but he only rented them if the olive season was a good one. Options to buy or sell seventeenth century Dutch tulips at a fixed price at some future time only failed because of inadequate market clearing mechanisms and settlement procedures to minimize credit risk and default.

Options on agricultural futures contracts arose during the seventeenth century because of inflexibility of the forward contractual mechanism and the inherent problems involved with futures margin settlement, at a time when actuaries were devising insurance-based solutions to manage risk. However, similar to each evolutionary stage in managing risk within the integrative supply chain, options have introduced a new set of issues.

What was very apparent by the seventeenth century was the willingness and capability to trade forward contracts. Delivery against a forward contract was not an issue because of the cash settlement alternatives. Tradeability, nondeliverability, and cash settlement of forward contracts had become the hallmarks of a futures market. But what was needed was a clearing mechanism to formalize the option to take up the underlying futures contract or forward contract if required.

The principle that futures hedging could offset and manage risk was sound because there was price protection if prices moved adversely. The

problem was the margin losses in the futures trading account and opportunity costs if physical prices moved favourably. Whilst futures hedging had the advantage of minimizing credit risk over forward contracting, there was a need in the futures market for greater flexibility in the offsetting mechanism. However, until adequate clearing and credit risk minimization mechanisms were introduced during the nineteenth century, the options market mechanism and price flexibility in agricultural supply chains was not sustainable.

Strategy flexibility

A physical seller usually wants protection only when prices fall, whilst having the flexibility to capture any upside price movement. Alternatively, a physical buyer generally wants protection only when prices rise, whilst having the flexibility to capture any downside price movement. What both physical sellers and buyers usually want is the best of both worlds—protection and flexibility.²

Options on futures contracts are capable of fulfilling an array of objectives such as offering price protection for sellers and buyers, enhancing price for farmers and end users, acting as alternatives for speculative storage and pooling strategies, and providing for catastrophe insurance. They are multipurpose with flexibility, even in their ability to substitute³ or replace⁴ government assistance programs.

Agricultural options contracts have been designed to expire five to ten business days prior to the start of the delivery period when futures contracts automatically revert to physical deliverable forward contracts. Therefore, agricultural options even provide the choice as to whether or not to take up the underlying futures contracts and deliver against them as forward contracts in the delivery period. Whilst options can be used on most products or assets, even on the spread of agricultural prices between calendar months, the discussion of options in this chapter will be confined to futures markets and forward contracts.

Options mechanics

Whereas insurance was singular in asset protection, the dilemma of the plurality of rising and falling agricultural commodity prices was solved in Holland by creating two new markets. Buyers of tulips bought call options that gave them the right but not the obligation to buy tulips at no higher than a ceiling price at harvest time. Alternatively, sellers of tulips bought put options that gave them the right but not the obligation to sell tulips at no lower than a floor price at harvest time.

Because calls were associated with demand and rising prices when ships arrived in port, calls became associated with the futures market position that profited on the upside, namely buy futures. Buying a call option gave the buyer the right when prices rose but not the obligation if prices fell to take up the underlying buy futures position. But there had to be a seller of calls who received payment through a premium and was willing to take the risk that prices would not rise substantially.

In contrast, because puts were associated with dumping product into a port warehouse and falling prices when there were no ships in port, puts became associated with the futures market position that profited on the downside, namely sell futures. Buying a put option gave the buyer the right when prices fell but not the obligation if prices rose to take up the underlying sell futures position. But there had to be a seller of puts who received payment through a premium and was willing to take the risk that prices would not fall substantially.

When the clearing mechanism was formalized in US futures markets in the second half of the nineteenth century, both call and put options markets on agricultural futures developed slowly because of liquidity issues. This was understandable given that liquidity even in the forward grain futures market was not substantial until the 1890s. There was always to be a risk: cost trade-off between options sellers and buyers that affected liquidity, but which was never going to be adequately resolved.⁵ What was very expensive for buyers was too cheap for sellers, given the high risk.

The duality of options markets on two different futures market positions worsened the liquidity issue. If a speculator expected prices to rise, then they would buy calls. Alternatively, if a speculator expected prices to fall, then they would buy puts. Speculators themselves were not going to resolve the illiquidity of options markets that was largely due to the lack of options sellers prepared to take risks. There had to be a special breed of speculator willing to gamble either on price stability or prices going in the opposite direction.

Market positions

There are four options market positions because there is market for buyers and sellers of calls, and a market for the buyers and sellers of puts.⁶ The buyer of calls and the sellers of puts are long, whereas the buyer of puts and the seller of calls are short.

Long options positions:	Buy calls and sell puts
Short options positions:	Buy puts and sell calls

In Figure 6.1, the buyer of the call pays the premium which the seller retains as profit. The value to a call buyer increases as prices rise above the strike price, with profit being achieved once the breakeven is reached and prices rise. Alternatively, the seller of the call loses value as prices rise above the strike price, with losses occurring once the breakeven is reached and prices rise.

In Figure 6.2, the buyer of the put pays the premium which the seller retains as profit. The value to a put buyer increases as prices fall below the strike price, with profit being achieved once the breakeven is reached and prices fall. Alternatively, the seller of the put loses value as prices fall below the strike price, with losses occurring once the breakeven is reached and prices fall.

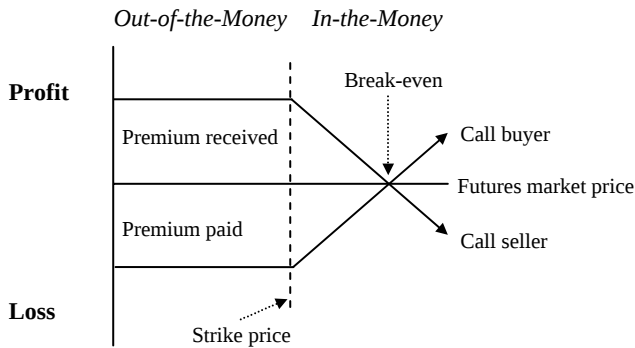


FIGURE 6.1 Profit and loss of a call option

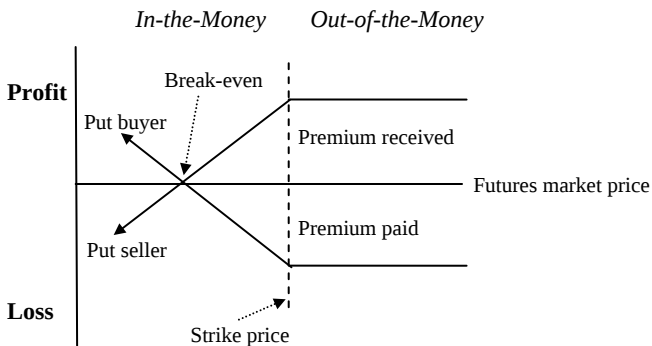


FIGURE 6.2 Profit and loss of a put option

The buyer can exercise the options once the strike price is reached, therefore the strike price becomes synonymous with the exercise price. There must be intrinsic value in the options contract before a buyer exercises the option to take up the underlying futures contract. The intrinsic value of an options contract is its current monetary value and is measured by the difference between the strike price and the current underlying futures price, multiplied by the size of the contract.

As an approximate guide depending on liquidity and transaction cost, the premium of an ATM call option should equal the premium of an ATM put option. This is referred to as the Put-Call Parity, and it is a measure of the efficiency of an options market and the ability to arbitrage price discrepancies.

Call options

ITM call: $\text{current futures price} > \text{strike price}$

OTM call: strike price > current futures price

Intrinsic value of a call option = current futures price – strike price

When the buyer exercises an in-the-money call option with intrinsic value, buy futures positions are allocated by the Clearing House at the strike price that was determined when the option was initially established. These buy futures positions can be roundturned and exited at the current market price. If call options are in-the-money and still open at the expiry date of the option, then the Clearing House automatically exercises the options for the buyer.

Assuming that a buyer has call options at a strike price of \$900 and the futures price rises to \$1000, the buyer can exercise the call options because there is an intrinsic value of \$100.

Call buyer allocated buy futures @ \$900	= Profit \$100
which are roundturned @ \$1000	
Call seller allocated sell futures @ \$900	= Loss \$100
which are roundturned @ \$1000	

The profit and loss between the options buyer and seller must balance for the Clearing House, which recoups its operational costs through the brokerage fee. If the call is not profitable to exercise, the buyer merely loses the premium to the seller, and the main role for the Clearing House in this situation is the debit and credit of the premium between the buyer and seller in the options contract.

Put options

Strike prices for put options which are above the current futures price are ITM because of intrinsic value. Alternatively, strike prices for put options which are below the current futures price are OTM because of no intrinsic value.

ITM put:	strike price > current futures price
OTM put:	current futures price > put strike price
Intrinsic value of a put option = Strike price – current futures price	

When the buyer exercises ITM put options with intrinsic value, sell futures positions are allocated by the Clearing House at the strike price that was determined when the options contract was initially established. These sell futures positions can be roundturned and exited at the current market

108 Options hedging and price enhancement

price. Again, if put options are ITM and still open at the expiry date of the option, then the Clearing House automatically exercises the options for the buyer.

Assuming that a buyer has put options at a strike price of \$500 and the futures price falls to \$300, the buyer can exercise the put options because there is an intrinsic value of \$200.

Put buyer allocated sell futures @ \$500	= Profit \$200
which are roundturned @ \$300	
Put seller allocated buy futures @ \$500	= Loss \$200
which are roundturned @ \$300	

The profit and loss between the options buyer and seller balances for the Clearing House. If the put option is not profitable to exercise, the buyer merely loses the premium to the seller.

Option premium

The cost of an option is reflected through its price, which is also known as the premium that is similar to the insurance market. Therefore, the cost, price, and premium associated with options on futures contracts are synonymous. The list of options strike prices will include premium schedules based on daily market movement because premiums vary with futures price movement.

Also similar to insurance, the buyer of the option pays the premium which the seller of the option receives. Apart from brokerage, the premium is the only loss to the buyer, whereas the premium is the only gain for the seller.

Evidence from clearing houses suggests that when the option seller immediately receives the premium, there is more willingness of options sellers to take new positions and thereby add to liquidity. In contrast, those options exchanges who delay the premium payment to the seller generally incur liquidity problems.

Low liquidity in options markets can be indicative of a large risk to the seller and a high premium for a buyer. The higher the risk, the higher the premium demanded by the options seller, and the lower the liquidity because the buyers are disinterested because of the high premium. What may be perceived as too expensive for buyers is perceived to be inadequate compensation to options sellers for the risk taken. This can widen the bid: offer spread for premiums at each strike price within each options contract

month. Whenever liquidity is inadequate, it is the role of the options exchange to become a marker-maker and adjust premiums daily given both intrinsic and estimated extrinsic values.⁷

An options premium is directly proportional to the intrinsic value of the options contract plus profit for the options seller.⁸ The premium of an option will increase with more ITM strike prices, and decrease with more OTM strike prices.⁹

There are extrinsic factors that can influence the options price, such as the price trend or volatility of the underlying futures price, as well as the time decay of the option and the cost of money.¹⁰ Call premiums will generally increase as prices rise and decrease as prices fall. However, historical agricultural price skewness does have an impact on put premiums. Because of the high propensity of agricultural prices to fall after a rise, put premiums increase as prices fall, but may also increase as prices rise.

Rising prices:	Both call and put prices can rise
Falling prices:	Put prices rise and call prices fall

Options prices usually increase with increasing price volatility because there are more opportunities for options buyers to exercise the option profitably.¹¹ In contrast, options prices decrease with decreasing price volatility because there is less probability that the options buyer will exercise the option.¹² Price volatility should be measured by frequency of price movement, rather than an historical price range standard deviation. A strong price trend should have low volatility, whereas high volatility should suggest trend uncertainty.

Increasing price volatility:	Call and put prices rise
Decreasing price volatility:	Call and put prices fall

Vega or Kappa is the change in the options price, given a 1 percent change in price volatility. It indicates how fast the option price changes when price volatility changes, but it is a vague concept unless volatility is objectively and accurately measured over time. Implied volatility is the price volatility implied by the options price, but this may be difficult if there is a strong trend influencing options prices rather than any frequency of price movement.¹³

The options premium will increase given a greater time to the expiry date of an options contract because of the higher risk to the options seller. Alternatively, the less time to the expiry date of an options contract, the

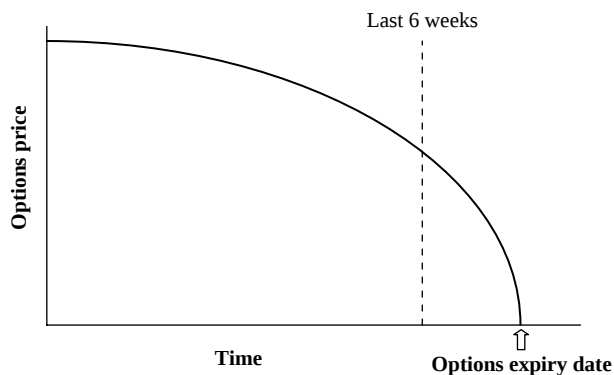


FIGURE 6.3 Options price with time decay

smaller the risk to the options seller and the options premium should be less. Theta measures the change in the options price given a change in the time to expiry, but this assumes other variables are static when they are in fact very dynamic.

Most of the time decay in the options price occurs in the last six weeks prior to the expiry date of the options contract (Figure 6.3). If exiting was being considered for an options buyer, then doing so before the last six weeks could recoup some of the original premium paid. This has implications in options hedge timing. Alternatively, choosing a more distant month when opening the options contract might better enable closing out at a higher premium, but there would be a higher initial premium because of the extra time value.

Interest rate changes and the cost of money as reflected through Rho have more impact on equity and financial derivatives options. Whilst there are no daily margin settlements for options buyers, they do exist for options sellers, which then requires some consideration of the cost of money as reflected through prevailing interest rates.¹⁴ Some futures brokers require substantial trading account balances for the options buyer on the understanding that exercising the option could occur and then holding the underlying futures contract which has initial margins and daily margin settlements.

Closing out options

Both options buyers and sellers can close out options positions at any time by exiting the position through roundturning. The buyer could close out an OTM options position, or as an alternative to exercising an ITM option so

as to avoid exposure to any potential margin and liquidity risk in the futures market. A seller could close out an options position to take profit and avoid the potential for subsequent losses.

If a buyer of a call paid \$1 per tonne in premium and prices subsequently rose, then the buyer might want to simply close out at \$2 per tonne in lieu of exercising the call option. The strike price relative to the futures price is important in this situation, but any intrinsic value in exercising the option is subsumed by the options price movement. Exiting at \$2 per tonne provides the call buyer with a net profit of \$1 per tonne less brokerage.

Alternatively, if a seller of a call received \$1 per tonne in premium and prices subsequently fell, then the seller might want to close out at \$0.50 per tonne because of the risk that prices could subsequently rise again and the buyer might exercise the option when it is ITM. Exiting at \$0.50 per tonne provides the call seller with a net profit of \$0.50 per tonne less brokerage.

In contrast, if a buyer of a put paid \$5 per tonne in premium and prices subsequently fell, then the buyer might want to simply close out at \$10 per tonne in lieu of exercising the put option. Again, the strike price relative to the futures price is important in this situation, but any intrinsic value in exercising the option is subsumed by the options price movement. Exiting at \$10 per tonne provides the put buyer with a net profit of \$5 per tonne less brokerage.

Alternatively, if a seller of a put received \$5 per tonne in premium and prices subsequently fell, then the seller might want to close out at \$6 per tonne because of the risk that prices could subsequently fall further and the buyer might exercise the option at any time. Exiting at \$6 per tonne provides the put seller with a net loss of \$1 per tonne plus brokerage.

Options profit and loss

The profit of an option depends on the intrinsic value of the option and the premium. Intrinsic value of a call option occurs when the futures price is above the strike price. Alternatively, the intrinsic value of a put option occurs when the futures price is below the strike price.

Assuming intrinsic value for an options buyer:

Maximum profit for options buyer = Unlimited

$$\begin{aligned}\text{Profit for a call buyer}^\star &= \text{Intrinsic value} - \text{Premium} \\ &= \text{Futures price} - \text{Strike Price} - \text{Premium}\end{aligned}$$
$$\begin{aligned}\text{Profit for a put buyer}^{\star} &= \text{Intrinsic value} - \text{Premium} \\ &= \text{Strike Price} - \text{Futures price} - \text{Premium}\end{aligned}$$

Assuming intrinsic value for an options seller:

Maximum loss for options seller = Unlimited

Profit for a call seller** = Premium – (Intrinsic value)
 = Premium – (Futures price – Strike Price)

Profit for a put seller** = Premium – (Intrinsic value)
 = Premium – (Strike price – Futures Price)

Assuming no intrinsic value:

* Maximum loss for options buyer = Premium

** Maximum profit for options seller = Premium

Profit is unlimited for an options buyer, whereas the profit is limited to the premium received for an options seller. Alternatively, losses are limited to the options premium for the options buyer, whereas losses are unlimited for an options seller. If the intrinsic value of the option exceeds the premium value, then the seller of the option will incur a loss.

Reading an options market. Table 6.1 represents a range of strike prices for calls and puts for a particular contract month when the underlying futures price is \$700. There is more intrinsic value for calls at lower strike prices and therefore the premium will be higher. This contrasts with puts that have more intrinsic value at higher strike prices and therefore the premium will be higher. Liquidity as represented by the Open Interest is maximized at strike prices near the futures price, and decreases rapidly at more distant strike prices either because of the options premium cost or the lack of opportunity for expected price movement.

The first insight from reading this market is that there is a higher number of put options contracts opened at the ATM strike price of \$700 compared to the number of ATM call options. This suggests that more hedgers perceive downside risk and more speculators perceive the potential for downside gain in the put options market compared to the perception of upside risks and the potential for gains in the call options market. The bearish sentiment in the market is greater than the bullish sentiment. However, there are a large number of sellers of puts who are hoping that the market price either remains relatively steady or rises slightly.

A feature of options markets is that the net premium becomes much cheaper for in-the-money strike prices despite the seemingly high options price. The premium does not equate to options price because of intrinsic value. This can result in very cheap options for more ITM strike prices.

TABLE 6.1 Option price movement for a range of strike prices

<i>Strike price</i>	<i>Call premium</i>	<i>Call Open Interest</i>	<i>Put premium</i>	<i>Put Open Interest</i>
100	602	0	1	0
200	505	0	5	0
300	410	100	10	10
400	315	300	20	50
500	225	500	45	1000
600	140	1000	70	3000
700	90	5000	90	7000
800	65	4000	150	4000
900	50	2000	245	500
1000	30	500	330	100
1100	14	300	420	50
1200	8	150	515	0
1300	5	100	610	0
1400	1	10	705	0

Reading a call market. For lower strike price ITM calls, the options price may be high but the premium is low because of the intrinsic value. A speculator might be attracted to buy calls at such low ITM strike prices in the hope that prices will continue to increase and that each dollar rise in the futures price will be reflected in an options price rise. The problem for the speculator is that both the intrinsic value and the premium could be lost if futures prices fall, therefore there is a need to have an exit stop loss order in place.

Alternatively, speculators are largely discouraged with OTM higher strike prices for calls because of the opportunity cost, no intrinsic value, and the probability that a rise in the futures price will not be reflected in a rise in the options price. However, end users are far more likely to establish ceilings at critical OTM major strike prices on the upside.

At a strike price of \$1000, with a premium of only \$30, as in Table 6.1, there have been 500 call options established, presumably by end users who do not want prices to exceed \$1000, otherwise their business operations and cash flow capacity might be jeopardized. This is price protection for end users at critical upside maximum prices. Such a reading of a call market can indicate the critical desperation price levels for end users.

At a strike price of \$1400, it is probable that an end user has taken out 10 contracts at an extremely low price of \$1 because of catastrophe insurance. The probability of prices ever reaching \$1400 might be approaching zero, however for an extremely low premium an end user can safeguard business

operations and know that the viability of the business will continue despite an unusual price rise. This is protection against a worst-case scenario.

Reading a put market. For higher strike price ITM puts, the options price may be high but the premium is low because of the intrinsic value. A speculator might be attracted to buy puts at such high ITM strike prices in the hope that prices will continue to decrease and that each dollar fall in the futures price will be reflected in a put options price rise. The problem for the speculator is that both the intrinsic value and the premium could be lost if futures prices rise, therefore there is a need to have an exit stop loss order in place.

Alternatively, speculators are largely discouraged with out-of-the-money lower strike prices for puts because of the opportunity cost, no intrinsic value, and the probability that a fall in the futures price will not be reflected in a rise in the options price. However, farmers are far more likely to establish floors at critical major OTM strike prices on the downside.

At a strike price of \$500 with a premium of \$45 in Table 6.1, there have been 1000 put options established, presumably by farmers who do not want prices to fall below \$500, otherwise this might jeopardize their farming operations and cash flow requirements. There were only 50 puts established at \$400 with a premium of \$20, which might suggest that this strike price is too low for the majority of farmers who are seeking to establish minimum floor levels. This is price protection for farmers at critical downside minimum prices. Such a reading of a put market can indicate the critical desperation price levels for farmers at each downside strike price.

At a strike price of \$300, it is probable that a farmer has taken out 10 contracts at a very low price of \$10 as catastrophe insurance. This is protection against a worst-case scenario. The probability of prices ever reaching \$300 might be low, however for a very low premium a farmer can safeguard business operations and know that the viability of the farm will continue despite such a price fall. This explains why options hedging can be perceived to be a substitute for farm income protection schemes by government,¹⁵ and which can avoid many of the associated food and fibre supply chain distortions.¹⁶

Options hedging strategies

The psychology behind options hedging is uncertainty. If prices were more certain and strongly trending, then the use of futures contracts would be preferable because there would be no premium outlay and low margin risk.

As uncertainty increases, the increased margin risk with futures contracts is likely to promote the usage of options on futures contracts, despite the premium cost.¹⁷

Whereas synthetic hedging can involve the use of options to offset futures positions, or options to offset other options positions,¹⁸ physical options hedging involves offsetting a physical market position with an opposite options position. This provides the best of both worlds for farmers, merchants, and end users with both price protection and price flexibility. The use of options to offset physical market positions will only be considered in this section.

Buy call options hedge (ceiling). Buying a call option by itself will profit when prices rise, and lose the premium when prices fall. It is the combination of a short physical market position for end users and merchants with the offsetting buy call position that creates an options hedge with a cap or ceiling that protects them from adverse upside price movement and flexibility to benefit from any downside price movement (Figure 6.4).¹⁹

Physical short + buy call options = Long options hedge (ceiling)

An example is an end user buying calls over six months to protect against upside price risk by establishing a ceiling for 1000 tonne of commodity. Using the strike price schedule in Table 6.1, the end user selects an OTM strike price of \$1000 for a premium of \$30 for 20 buy calls. The physical forward price is \$650 per tonne and the futures forward price is \$700 per tonne. Table 6.2 indicates the options hedge result if the physical forward price rose to \$1200 per tonne and the forward futures prices rose to

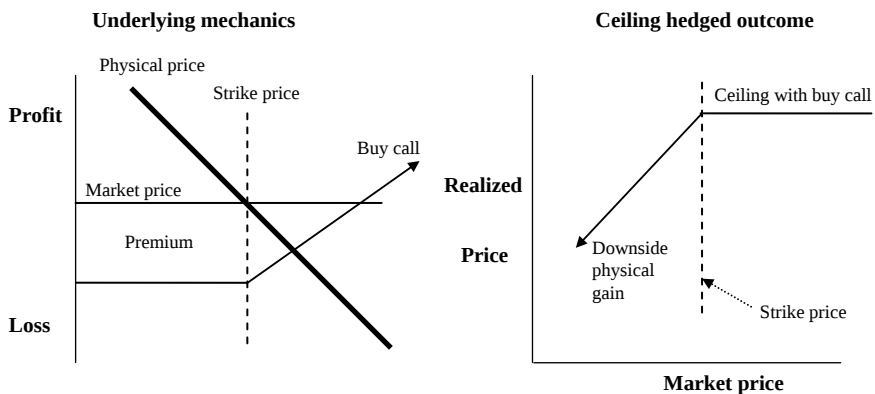


FIGURE 6.4 Buy call options hedge—ceiling mechanism

TABLE 6.2 Buy call options hedge with exercising options—ceiling strategy

Time	Physical Market	Options Market	Basis
Planning to buy	Intention: To buy 1000 tonne of commodity in 6 months time. Initial price: \$650/tonne * Risk: price will rise	End user takes out 20 OTM buy calls ** for \$30/tonne Premium value: $\$30 \times 50 \times 20 = \$30,000$	\$50/tonne cash under
6 months time	End user buys 1000 tonne of commodity at \$1200/tonne Value: $1000 \times \$1200 = \$1,200,000$	End user exercises the 20 buy call options at \$1300. Intrinsic value: $\$1300 - \$1000 = \$300/\text{tonne}$ $= \$300 \times 50 \times 20 = \$300,000$	\$100/tonne cash under
Hedge outcome	Physical 'loss' \$550/tonne Value 'loss' = \$550,000	Options gain = Intrinsic value – Premium $= \$300,000 - \$30,000 = \$270,000$	\$50/tonne
Realised price and value	Actual price – options gain $\$1200/\text{tonne} - \$270/\text{tonne} = \$930/\text{tonne}$ Value: $\$930 \times 1000 \text{ tonne} = \$930,000$		

* Physical forward price ** Based on forward options price

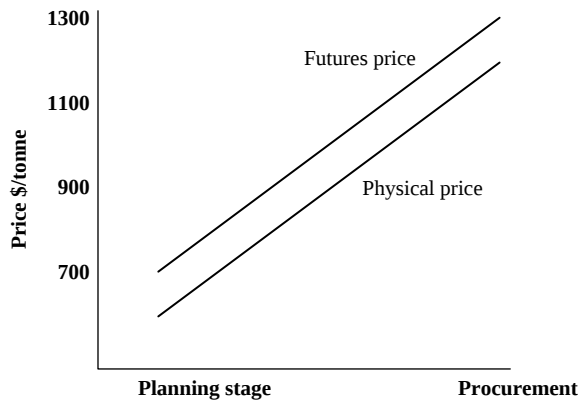


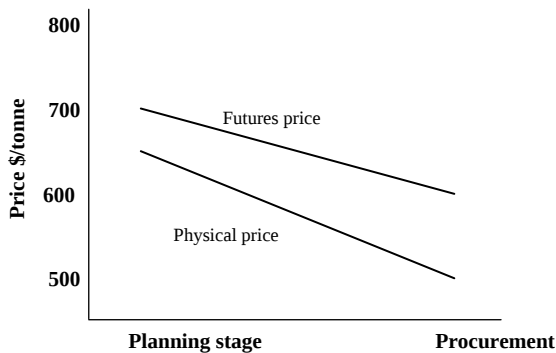
FIGURE 6.5 Favourable basis movement for end user with a buy call options hedge

TABLE 6.3 Buy call options hedge expiring worthless—ceiling strategy

<i>Time</i>	<i>Physical Market</i>	<i>Options Market</i>	<i>Basis</i>
Planning to buy	Intention: To buy 1000 tonne of commodity in 6 months time. Initial price: \$650/tonne *	End user takes out 20 OTM buy calls ** for \$30/tonne Premium value: $30 \times 50 \times 20 = \$30,000$	\$50/tonne cash under
6 months time	Risk: price will rise End user buys 1000 tonne of commodity at \$500/tonne Value: $1000 \times \$500 = \$500,000$	The 20 buy calls options expire worthless	\$100/tonne cash under
Hedge outcome	Physical 'gain' \$150/tonne Value 'gain' = \$150,000	Options loss = Premium = \$30,000	\$50/tonne
Realised price and value	Actual price + options loss \$500/tonne + \$30/tonne = \$530/tonne Value: $1000 \text{ tonne} \times \$530 = \$530,000$		

* Physical forward price

** Based on forward options price

**FIGURE 6.6** Favourable basis movement for end user with a buy call options hedge

\$1300 per tonne at which price the end user exercised the buy call options. It will be assumed that the standardized size of the futures contract is 50 tonne, brokerage is ignored, and there is perfect time alignment between price exposure and hedge beginning and ending.

In Table 6.2, the end user lost \$550 per tonne between the planning to buy and the actual buying time, but gained \$270 per tonne through the long buy call options hedge. When compared to no hedge that would have resulted in \$1200 per tonne, the long hedge was effective in that the end user realized \$930 per tonne. The ceiling price was \$1030 per tonne, which was the strike price plus the premium (\$1000 + \$30 per tonne), but in this case there was a favourable basis movement of \$50 per tonne that realized a \$980 per tonne price (\$1030 – \$50 per tonne). Factors that would affect the hedge outcome include selection of a different strike price, the hedge ratio, and the alignment of the quantity with the contract size, as would currency movement in an international hedge.

The issue with this hedge was that the end user was prepared to forego \$300 per tonne in the futures market by selecting a strike price of 1000. The trade-off to a lower premium is that hedge effectiveness will be reduced. In this particular case, there was favourable basis movement of \$50 per tonne (Figure 6.5), which partially offset the OTM strike price and increased the hedge effectiveness for the end user.

Table 6.3 indicates the options hedge result if the physical forward price fell to \$500 per tonne and the forward futures prices decreased to \$600 per tonne while the buy call options expired worthless. It will again be assumed that the standardized size of the futures contract is 50 tonne, brokerage is ignored, and there is perfect time alignment between price exposure and hedge beginning and ending.

In Table 6.3, the end user gained \$150 per tonne between the planning stage and procurement, but lost \$30 per tonne through the premium of the buy call options. When compared to no hedge that would have resulted in \$500 per tonne, the long hedge was still effective in that the end user had upside price protection with a ceiling of \$1030 per tonne if prices had risen.

There was favourable basis movement of \$50 per tonne in this particular case (Figure 6.6), but this did not affect the outcome because the buy call options expired worthless. Basis movement is only relevant to options hedging when there is intrinsic value.

Buy put options hedge (floor). Buying a put option by itself will profit when prices fall, and lose the premium when prices rise. It is the combination of a long physical market position for farmers and long merchants with the offsetting buy put position that creates an options hedge with a floor that protects them from adverse downside price movement and flexibility to benefit from any upside price movement (Figure 6.7).²⁰

$$\text{Physical long} + \text{buy put options} = \text{Short options hedge (floor)}$$

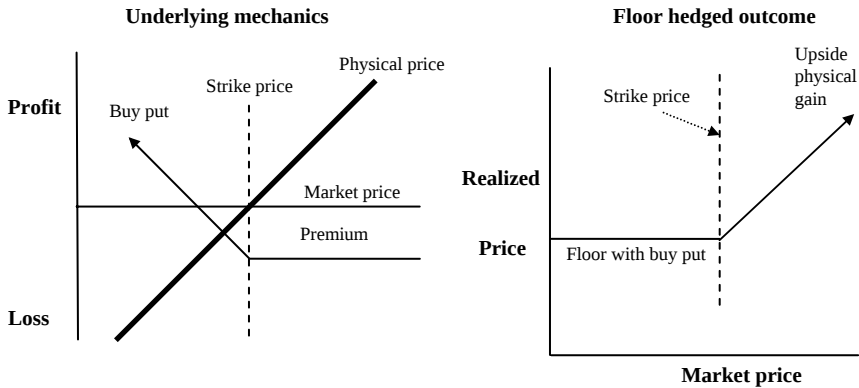


FIGURE 6.7 Buy put options hedge—floor mechanism

An example is a farmer buying puts over six months to protect against downside price risk by establishing a floor for 1000 tonne of commodity. Using the strike price schedule in Table 6.1, the farmer selects an OTM strike price of \$500 for a premium of \$45 for 20 buy puts. The physical forward price is \$650 per tonne and the futures forward price is \$700 per tonne. Table 6.4 indicates the options hedge result if the physical forward price fell to \$450 per tonne and the forward futures prices fell to \$400 per tonne at which price the farmer exercised the buy put options. It will assume that the standardized size of the futures contract is 50 tonne, brokerage is ignored, and that there is perfect time alignment between price exposure and hedge beginning and ending.

In Table 6.4, the farmer lost \$200 per tonne between planting and harvesting time, but gained \$55 per tonne through the short buy put options hedge. When compared to no hedge that would have resulted in \$450 per tonne, the short hedge was effective in that the farmer realized \$505 per tonne. The floor price was \$455 per tonne, which was the strike price less the premium ($\$500 - \45 per tonne), but in this case there was a favourable basis movement that assisted in realizing a price of \$505 per tonne. Futures price movement will affect the intrinsic value of the option, which then influences the realized price. Apart from basis movement, factors that would affect the hedge outcome include selection of a different strike price, the hedge ratio, and the alignment of the quantity with the contract size, as would currency movement in an international hedge.

The issue with this hedge was that the farmer was prepared to forego \$200 per tonne in the futures market by selecting a strike price of \$500. It is usual for a farmer to choose an OTM strike price because of the lower

TABLE 6.4 Buy put options hedge with exercising options—floor strategy

Time	Physical Market	Options Market	Basis
Planting	Intention: To sell 1000 tonne of commodity at harvest. Initial price: \$650/tonne * Risk: price will fall	Farmer takes out 20 OTM buy puts ** for \$45/tonne Premium value: $\$45 \times 50 \times 20 = \$45,000$	\$50/tonne cash under
Harvesting	Farmer sells 1000 tonne of commodity at \$450/tonne Value: $1000 \times \$450 = \$450,000$	Farmer exercises the 20 buy put options at \$400. Intrinsic value: $\$500 - \$400 = \$100/\text{tonne}$ $= \$100 \times 50 \times 20 = \$100,000$	\$50/tonne cash over
Hedge outcome	Physical ‘loss’ \$200/tonne Value ‘loss’ = \$200,000	Options gain = Intrinsic value – Premium $= \$100,000 - \$45,000 = \$55,000$	\$100/tonne
Realised price and value	Actual price + options gain $\$450/\text{tonne} + \$55/\text{tonne} = \$505/\text{tonne}$ Value: $1000 \text{ tonne} \times \$505 = \$505,000$		

* Physical forward price

** Based on forward options price

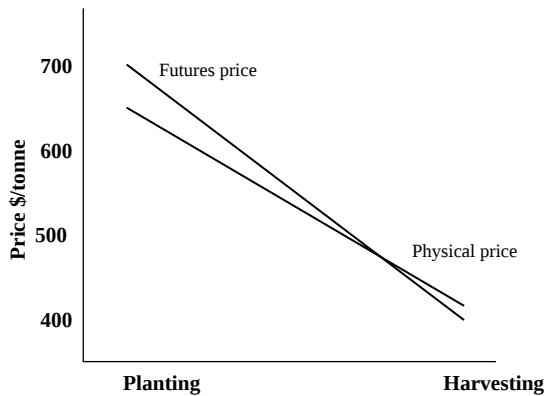


FIGURE 6.8 Favourable basis movement for farmer with a buy put options hedge

TABLE 6.5 Buy put options hedge expiring worthless—floor strategy

<i>Time</i>	<i>Physical Market</i>	<i>Options Market</i>	<i>Basis</i>
Planting	Intention: To sell 1000 tonne of commodity at harvest. Initial price: \$650/tonne ★ Risk: price will fall	Farmer takes out 20 OTM buy puts ** for \$45/tonne Premium value: $\$45 \times 50 \times 20 = \$45,000$	\$50/tonne cash under
Harvesting	Farmer sells 1000 tonne of commodity at \$700/tonne Value: $1000 \times \$700 = \$700,000$	The 20 buy put options expire worthless	\$100/tonne cash under
Hedge outcome	Physical 'gain' \$50/tonne Value 'gain' = \$50,000	Options loss = Premium = \$45,000	\$50/tonne
Realised price and value	Actual price – options loss $\$700/\text{tonne} - \$45/\text{tonne} = \$655/\text{tonne}$ Value: $1000 \text{ tonne} \times \$655 = \$655,000$		
★ Physical forward price		★★ Based on forward options price	

cost of the options premium.²¹ The trade-off to a lower premium is that hedge effectiveness will be reduced. In this particular case, there was favourable basis movement of \$100 per tonne (Figure 6.8), which partially offsets the OTM strike price and increased the hedge effectiveness for the farmer.

Table 6.5 indicates the options hedge result if the physical forward price rose to \$700 per tonne and the forward futures prices rose to \$800 per tonne while the buy put options expired worthless. It will again assume that the standardized size of the futures contract is 50 tonne, brokerage is ignored, and there is perfect time alignment between price exposure and hedge beginning and ending.

In Table 6.5, the farmer gained \$50 per tonne between planting and harvesting time, but lost \$45 per tonne through the premium of the buy put options. When compared to no hedge that would have resulted in \$700 per tonne, the short hedge was still effective in that the farmer had downside price protection with a floor of \$455 per tonne if prices had fallen.

There was unfavourable basis movement of \$50 per tonne in this particular case (Figure 6.9), but this did not affect the outcome because the buy put options expired worthless. Again, basis movement is only relevant to options hedging when there is intrinsic value.

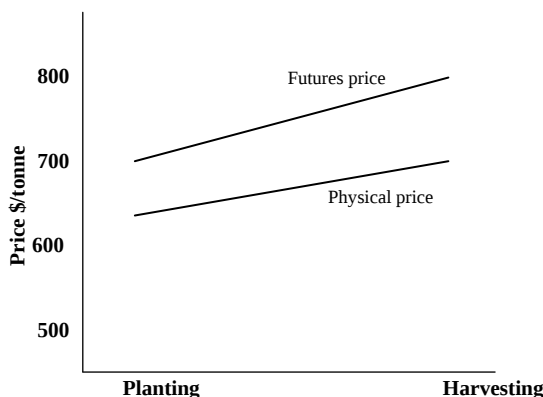


FIGURE 6.9 Unfavourable basis movement for farmer with a buy put options hedge

Collars. The cost of the premium for the buyer is one of the major adoption problems for options hedging. Options sellers may be willing to sell for high premiums, but options buyers may be unwilling to pay the high premium. It is possible for options buyers to lower the premium cost of a hedge by selling an opposite option. Such strategies are referred to as collars.²² There must be a physical position offset by two options of the same position.

A long collar is established by a short physical position offset by two long positions with a buy call and a sell put. It is a hedge because the buy call is the primary long hedging mechanism with the original short physical position being offset. The sell put is only introduced to reduce the cost of the buy call, thereby limiting the flexibility of the hedge and reintroducing margin settlement risk (Figure 6.10).

$$\text{Long collar} = \text{Physical short} + \text{buy call} + \text{sell put options}$$

Alternatively, a short collar is established by a long physical position offset by two short positions with a buy put and a sell call. It is a hedge because the buy put is the primary short hedging mechanism with the original long physical position being offset. The sell call is only introduced to reduce the cost of the buy put, thereby limiting the flexibility of the hedge and reintroducing margin settlement risk (Figure 6.11).

$$\text{Short collar} = \text{Physical long} + \text{buy put} + \text{sell call options}$$

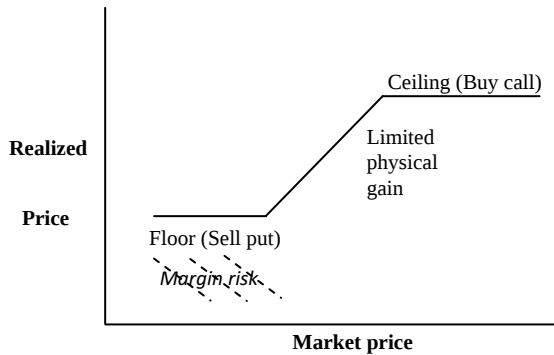


FIGURE 6.10 Long collar with limited flexibility and margin risk

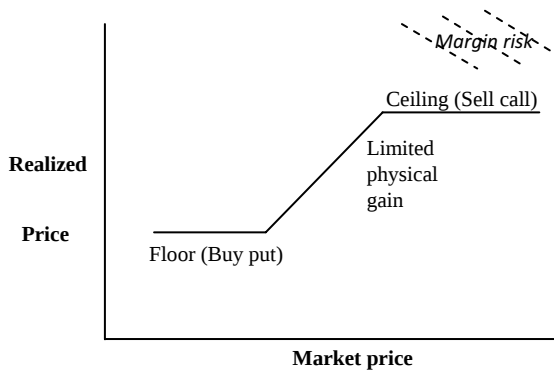


FIGURE 6.11 Short collar with limited flexibility and margin risk

Catastrophe insurance. Although a farmer uses buy put options to establish a floor, and an end user uses buy call options to establish a ceiling, OTM options cannot be regarded as strictly hedging strategies because of the price protection foregone. An extreme OTM option is not focused on price protection but rather worst-case defence. It can be better described as catastrophe insurance.

A food manufacturer such as a flour miller might establish a worst-case wheat input price, beyond which the operations would be jeopardized because of shortages of cash flow or working capital, or contributing to major financial losses. In the example of the end user using catastrophe insurance with a call strike price of \$1400 for a very cheap premium of \$1 (Table 6.1), there would have to be a price rise of \$701 from the current price of \$700 before the ceiling of \$1401 was reached.

A farmer might establish a worst-case price, beyond which the farming operations would be jeopardized because of shortages of cash flow or working capital, or contributing to major financial losses. In the example of the farmer using catastrophe insurance with a put strike price of \$300 for a very cheap premium of \$10 (Table 6.1), there would have to be a price fall of \$410 from the current price of \$700 before the floor of \$290 was reached.

Price enhancement. The ability to buy calls or puts after a fixed-price transaction has occurred introduces price flexibility and improves the adoption of price risk management. As well, importers are less tempted to renege on contracts when they know that they can enhance their price on the downside using buy put options. If a forward contract has been agreed upon at a fixed price, the seller can subsequently enhance price on the upside through buying call options, whilst the buyer can subsequently enhance price on the downside through buying put options. The subsequent use of buying options takes price out of the supply chain relationship between buyers and sellers and minimizes opportunity costs.

Storage alternative. The ability to enhance price after an early sale transaction can encourage a farmer to sell into the commercial supply chain rather than undertake hoarding or pooling. This removes the temptation to withhold supply. A cash sale at harvest provides the cash flow to pay for the premium of the buy call. Basis risk has been eliminated because the physical product has been sold, whilst currency risk is minimized. The assumptions are that upside price opportunities exist and there is an effective options market available.

This cash sale plus buy call strategy reinstates the speculative long market position for the farmer, which can replace the desire for hoarding. There are cost savings by not incurring storage costs, postharvest quality deterioration, old crop price discounts, price falls, currency rises, and opportunity costs of cash flow foregone.

Minimum price forward contracts. The dilemma of any merchant is getting the farmer to sell in an anticipatory forward sale before harvest. From the risk perspective of the farmer, there is production and specification risk, delivery risk, and opportunity costs if prices subsequently rise. A stand-off can occur with merchants wanting physical throughput to maintain profitability whereas farmers want to maximize their pricing opportunities.

If a merchant has back-to-back contractual obligations, then the only method to enhance price to a farmer after a supply agreement has been

reached is to take out buy call options. The premium is offset by a price discount to the farmer, which depends on the strike price of the buy call options, while the upside is derived from the buy call profit.

Legal questions with this method can arise because the merchant is responsible for the buy call, yet the benefits are given to another party, which requires careful preparation of contract terms. Provided that price never rose above the strike price of the buy call, there can be no cause for concern by the farmer. However, if price rose above the strike price, then the contract needs to detail under what circumstances the merchant is liable for payout.

Price could rise and then fall by contract settlement time, and the merchant might not be liable for any payout on the buy call option. Alternatively, if there was intrinsic value in the call option, the merchant could close out the contract instead of exercising the option. The movement in the underlying futures price might not be reflected in the call price movement. Naming these forward contracts as minimum price forward contracts or guaranteed minimum price forward contracts (GMPs) can be misleading. The question arises as to why the merchant should even be responsible for the buy calls when these can be established by the farmer after signing a fixed price forward contract.

If the merchant does not have a back-to-back supply chain relationship after signing the purchase contract, the merchant will have a long position with downside price exposure. The merchant could decide to hedge the downside exposure with a buy put option, thus establishing a floor, but pass any upside physical gain back to the physical seller in a minimum price forward contract. This method offers more transparency because there is a physical price discount that may reflect the cost of buying put options for the merchant with upside that is dependent on the physical price movement. However, any upside payment to the farmer needs to be benchmarked against a competitive, efficient, public, and transparent physical market price at a predetermined date which is usually when physical delivery occurs.

Maximum price forward contracts. If merchants have difficulty in getting farmers to forward sell, they also have difficulty in getting farmers to forward buy farm inputs such as feed grain. Unless there are added benefits of downside price enhancement, feed grain buyers are more likely to buy in the spot market.

Merchants who forward sell feed grain are highly likely to be in a long market position with either existing or forward committed supplies. The

only strategy to offer price enhancement on the downside for end users is to lock in a forward contract with a buy put attached.

Similar to the minimum price forward contracts, price could fall during the duration of the contract but rise at settlement time. The end user could claim that the merchant should have exercised the buy put option at a more opportune time. Perhaps the movement in the futures market was not reflected in the put options price when closing out the position. Many feed grain end users have misinterpreted a maximum price forward contract or a guaranteed maximum price contract to be a forward contract with a maximum price, whereas it is a ceiling price contract with downside gain.

Delta hedging

Delta is the change in the options price given a change in the underlying futures price.²³ It measures the responsiveness of the options price to the futures price, which depends on the strike price relative to the futures price. Delta has importance to both hedgers and speculators.²⁴ Gamma is the change in Delta given a change in the underlying futures price.

The more intrinsic value there is in the option, the more likely is Delta to approach 1, which would indicate that the options price movement should equal the futures price movement. Delta for an option that is at-the-money could approximate 0.5, suggesting that the options price will be only moving half that of the underlying futures price. The more an option moves out-of-the-money, the more likely is Delta to approach 0, which results in the options price being unresponsive to futures price movement.

Whereas the tactic of being Delta-neutral by maintaining exact hedge ratios can be applied to synthetic hedging with futures exposure exactly offset by options contracts,²⁵ it has little application to an anticipatory physical hedge with low hedge ratios and risks associated with production, basis, and currency movement.²⁶ In contrast, Delta hedging has application to a commodity pool manager who needs to operate under a policy of maintaining strict hedge ratios such as hedging one-third of the pool.²⁷

Using options hedging provides downside protection as well as meeting the upside price goals for farmers in an unsold commodity pool.²⁸ If the commodity pool was 100,000 tonne, and the hedge policy was for a 30 percent hedge ratio, then hedging 30,000 tonne would be required. Assuming a 50 tonne options contract, then a Delta of 1 would require 600 buy put options contracts. If Delta was 0.6, then this would require $600 \times 1 / 0.6 = 1000$ buy put options contracts, whereas if Delta decreased to 0.4, then this would require $600 \times 1 / 0.4 = 1500$ buy put options contracts, which

would require the pool manager to buy an additional 500 puts. If Delta increased from 0.6 to 0.8, the pool manager would be required to sell 250 puts.

Strict Delta-hedging favours the futures broker because of continual changes in the number of options contracts. Delta might be assessed at the end of each month and the hedge position changed, rather than having any daily or weekly adjustment. However, much depends on the probability of price trends and volatility, as well as timing.²⁹

7

OVER-THE-COUNTER PRICING PRODUCTS

There was an era before electronic and volume banking when clients negotiated customized financial transactions with a bank manager across the bank counter. An over-the-counter (OTC) product was designed to meet the individual needs of a client through product bundling. A home loan mortgage package with individualized principal and interest repayments, duration, and flexibility was a typical over-the-counter bundled bank product. Banking cost efficiencies quickly replaced customized solutions with more generic products once financial deregulation occurred, with volume-focused banks quickly expanding some of the more traditional roles of trading banks.

The primary role of a bank in a supply chain is to finance farmers, merchants, and end users through credit facilities.¹ However, an integrated supply chain merchant with product ownership using adequate bank funding can also finance both the farmer and end user. There has been a traditional close nexus between banks and merchants throughout history,² especially during the mercantile era,³ and hence the term merchant bank. Some banks in the absence of merchants may actually become physical merchants and buy pooled commodity at a price before selling it back to pool management, simply to finance commodity pools within credit risk limits but without taking physical delivery. These financing or funding instruments are known as Total Return Swaps.

The other main function of banks in agricultural supply chains is currency management. It is no coincidence that the rise in agricultural pricing products has been most prominent in countries outside of the USA, who

conduct international trade or have domestic pricing based on US dollar denominations. This explains why over-the-counter pricing products have been somewhat muted in the USA, because the need has not been as great. If domestic pricing is dependent on US dollar prices, then domestic transaction exposure is just as important as international trade currency exposure.

Similar to financial products, OTC commodity pricing products quickly shifted from customized to generic under deregulation.⁴ Morgan Stanley and Goldman Sachs offered both OTC commodity pricing swaps and options-based products to clients to manage their oil price exposure during the late 1970s when there were problems with margins and forward liquidity associated with normal futures hedging.⁵

Regardless of the historical debate over the similarities and interchanges between banks and merchants, the two distinguishing factors dividing commercial merchants from investment banks is the need for delivered physical product throughput for the former and the existence of an adequate clearing settlement mechanism supported by credit risk security in the latter. Alternatively, a commercial merchant does not have an adequate clearing settlement mechanism and credit risk security, whereas an investment bank does not want physical product delivery. A cash-settled OTC product requires no physical delivery but there must be adequate clearing settlement mechanisms and credit risk security. These factors preclude commercial merchants from OTC pricing products.⁶

Many attempts by commercial merchants to copy or compete with investment banks without the necessary settlement clearing mechanisms and credit risk security have failed.⁷ There were inadequate cash-settlement clearing and credit risk security mechanisms for commercial merchants associated with the hedged-to-arrive contract defaults in the USA during 1996⁸ and in Australia in 2007.

Financial deregulation has facilitated an evolutionary phase with bank clients firstly wanting currency protection, then funding of margins in futures hedge accounts, and then to hedge rollovers that may require forward market-making by banks. Bundling such a bank product can offer a client a three-year domestic price with margins fully financed until settlement date. These products became known as commodity swaps, because the margin differences between the locked-in swap price and the swap market price were swapped at settlement between the swap buyer and swap seller.

Commodity swaps cannot be classified as a new derivative instrument because they traditionally were simply cash-settled forward contracts in a private swap market. Flexibility was added through existing options contracts to establish floors, ceilings, and collars.

Bank swap prices make little contribution to basis benchmarking. Whereas banks may take commodity ownership title because of credit risk, they reject the logistics of physical delivery which is the vital component in basis determination. Whilst swap prices are usually made dependent on the most liquid and relevant futures market, which in most cases is the US futures market price, bank profit is built into the swap buy and sell prices. A bank swap price has therefore never become a commodity benchmarking price. It is more accurate to benchmark basis directly from the futures market price.

The most recent evolutionary phase of over-the-counter products has come through the US with the Dodd Frank Act 2010. US futures exchanges can now bundle exchange-traded derivative instruments and offer them to clients through futures brokers. Because they are daily margin settled, these exchange traded swaps use the exchange clearing house settlement procedures. They usually break the normal swap rules because they are daily margin settled and not merely margin swapped at settlement, and they can be either cash-settled or deliverable depending on the underlying commodity futures contracts.

A CME Australian dollar wheat swap consists of either a Chicago soft wheat or a Kansas hard wheat futures contract settled daily against the Chicago Australian dollar futures contract rate. Unlike bank commodity swaps, these exchange swaps have no margin funding facilities and they are limited to the forward liquidity in the futures market. However, exchange traded swaps can be cheaper because there is less need to hedge currency which results in less brokerage and margin costs. Because of the daily margin settlements as well as little need for currency hedging, less working capital is tied up when compared to the asset security required for bank swaps.

OTC markets

It is easy to define a market as a willingness and capability of buyers and sellers to consummate transactions with varying time frames and price movement expectations, but it has become extremely difficult to confine the dimensions of many new modern markets,⁹ especially when they have global extensions and international clearing settlement mechanisms.¹⁰ However, any type of market must still be based on volume-driven physical buyer and seller activity whose product transaction consummation is efficiency reflected in price that needs some transparency if such markets are to have relevance. Price is meaningless without an intention to produce and sell or buy product. Fees and costs apply in service industries but not price.

The clearing mechanisms of investment banks have made them indispensable in the clearing house operations of futures markets. Investment banks are able to act as futures brokers, futures exchange clearing members, and operators of private markets such as linking exporters with importers in currency transactions. They form the new membership of futures exchanges, usually replacing the previous agricultural merchants and end users who historically formed the majority of futures exchange membership.

Attempting to create new public markets for many agricultural cash-settled nondeliverable OTC products has been the vogue amongst investment banks for 20 years and more recently amongst futures exchanges.¹¹ However, merely listing a new product on a private market or a new contract on a futures exchange without an underlying commercial trade market has had a long history of failure, especially for agricultural commodities.¹² Despite poor connectivity to a physical commercial market, some investment banks and futures exchanges have listed cash-settled nondeliverable contracts through electronic market platforms using the clearing settlement mechanisms of the investment bank, under the public auspices of a futures market.¹³

Cash settlement of contracts and off-exchange private transactions have been regularly debated over the past 100 years, even before The (US) Futures Trading Act of 1921, and subsequently through the US 1922 Grain Futures Act, US Commodity Exchange Act of 1936 and its amendments in 1938, 1940, 1958, 1968, and extending into US Public Law 95-444 during 1978-83 and the Futures Trading Act 1982. The problem with any market for nondeliverable cash-settled contracts is that they are not confined to the physical delivery limits and effective basis limitations of any underlying physical commercial trade market, which often makes them illiquid and vulnerable to manipulation either by market makers or traders.¹⁴

The serious flaw in investment banks establishing private agricultural commodity markets was that they falsely assumed that they could link willing buyer clients to willing seller clients simultaneously.¹⁵ What may occur in nonseasonal bond markets and other interest-rate-derived financial markets was never going to occur with agricultural commodities that had large seasonal supply, demand, and hoarding variations. Whenever agricultural buyers wanted to buy in rising markets, sellers were unwilling to sell, whereas buyers were generally disinterested when sellers wanted to sell in falling markets.

No amount of investment bank coercion was going to change this stand-off dilemma without the inclusion of speculators, whose propensity for risk taking exceeded normal commercial propriety, but speculators were only

allowed in futures markets. Because investment bank policy and government regulation prevented speculator inclusion in their private agricultural market attempts, the establishment of private agricultural markets by investment banks failed repeatedly.¹⁶

After 100 years of debate, OTC cash-settled products were finally allowed to be listed on US futures markets.¹⁷ The main difference between the establishment of private agricultural markets by investment banks and the development of exchange traded OTC markets in the USA is that the latter includes speculators who can add volume to market liquidity.

The limitations of futures markets and the cash settlement of contracts will be discussed further in Chapter 11.

OTC pricing methods

Price has to be established somewhere to have relevancy, although government-determined prices usually have the least relevancy in dynamic supply chains. Banks have two choices to establish a price mechanism. Either they can simply price from a liquid futures market, or they can attempt to establish price through their own private cash-settled swap market between buyer and seller clients. The first method reduces banks to mere futures brokers with little bank profit potential but with a higher probability of success, whereas the second offers more bank profit potential but less probability of success for agricultural products because of illiquidity.

A bank pricing product might have its futures component established in a futures market by the bank operating as a futures broker, yet its currency component established in a privately established internal market between exporter and importer clients of the bank. The futures and currency components are bundled together as a domestically priced OTC product.

The focus of the remainder of this chapter will be on the benefits and limitations of cash-settled agricultural OTC bank pricing products that are based on deliverable futures contracts, and offered by banks acting as futures brokers. OTC prices are therefore derived from the futures market price, which is then derived from the underlying physical commercial trade market.

Types of agricultural OTC bank pricing products

If banks merely offset client's market position risk on futures exchanges acting as futures brokers, then structured agricultural OTC pricing products are restricted by the selected exchange-traded hedging instrument.¹⁸

This reduces agricultural OTC bank pricing products to commodity swaps that are equivalent to futures hedging, and options-based hedging through floors, ceilings, and collars.¹⁹ A slight OTC variation to either a floor or a ceiling can be known as a participating forward.

Commodity bank swaps. These are forward contracts that are cash settled at contract maturity. Margin settlement still occurs, but only at contract maturity. The bank absorbs the daily margin settlements on the futures market through its treasury operations, thereby funding the futures market position for the client, with the cost of funding reflected through the swap entry and swap exit price. Bank clients are only made aware of the final net settlement at contract maturity based on swap market prices.

Bank bid: offer spreads in a swap market are indicative of the operating margin for the bank. The swap price will be above or below the market price depending on market position. This is the same situation as for currency.

Apart from margin funding, the main differences to a normal futures contract are that the bank swap contract has no facility to deliver the physical underlying product, and there is the choice to combine the futures price and currency into a bundled pricing product in local currency denomination. The client initially decides on the duration of the swap, which may involve the bank rolling over the futures hedge, with added costs reflected in a wider swap bid: offer spread for more distant months. In the case of a wheat swap, the client can choose the futures exchange as well as the contract month. Canola swaps could be based either on Winnipeg or Paris futures exchanges, while sugar swaps can be based on either New York or London futures exchanges.

Settlement of a commodity swap at contract maturity therefore depends on market position. Figure 7.1 details the cash settlement required at maturity for a producer commodity bank swap. The producer is long and offsets the physical downside price risk with a short swap, which profits on the downside and loses on the upside, equivalent to a sell futures contract.

If the market price falls below the swap price at settlement, then the bank pays the producer the price difference as reflected through the value. Alternatively, if the market price rises above the swap price at settlement, then the producer pays the bank the price difference as reflected through the value.

In effect, the cash settlement of the commodity bank swap at contract maturity for a producer reflects the default position in a physical forward contract that was not delivered against. The daily margin settlement of a sell

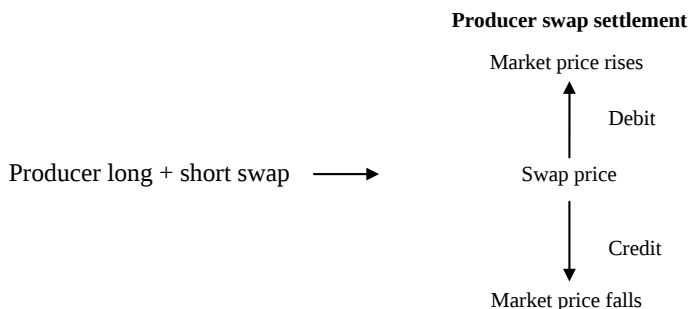


FIGURE 7.1 Cash settlement for a producer commodity swap

futures position also reflects the default position of a producer in a forward contract.

If the swap market price rises, the gains on the physical market would be expected to offset the losses on the swap settlement. However, basis risk remains the responsibility of the client, with adverse basis movement causing swap losses to exceed physical gains, but much depends on currency movement. This is the same as futures hedging. It is the responsibility of the bank client to adjust the number of swaps according to the anticipated production and hedge ratio required, and to be responsible for basis risk.

Similar to futures hedging, the client can exit bank swap contracts at any time, but at the prevailing swap market price. If a client exited a December swap in July, then the swap settlement price would be the prevailing December swap price in July, albeit with a time value of money adjustment if the client wanted an early payout.

Figure 7.2 details the cash settlement required for an end user (consumer) commodity bank swap. The end user is short and offsets the physical upside price risk against a long swap that profits on the upside and loses on the downside, equivalent to a buy futures contract.

The cash settlement of an end user bank swap can either reflect the defaulted position of an end user physical forward contract or that of a buy futures position. If the swap market price rises above the swap price at settlement, then the bank pays the end user the price difference as reflected through the value. Alternatively, if the market price falls below the swap price at settlement, then the end user pays the bank the price difference as reflected through the value.

Again, it is the responsibility of the bank client to ensure that the gains and losses on the physical and swap market offset each other, especially

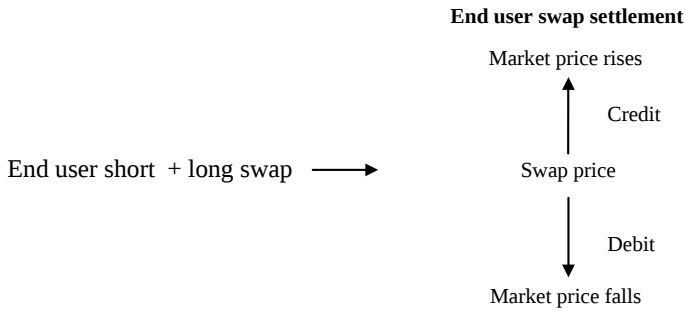


FIGURE 7.2 Cash settlement for an end user commodity swap

when currency movement is involved. The hedge ratio and basis movement are made the responsibility of the bank client.

Apart from the opportunity cost associated with a fixed price in a trending market, another major disadvantage of bank swaps is the opportunity cost of money involved with the security deposit or bank mortgage that is required to cover the credit risk involved with final cash settlement. Major swap settlement losses could occur for a farmer in a year of a production shortfall in a drought year with prices spiking, especially when there is no quick exiting of the swap position.²⁰ Swap settlement losses have been known to overwhelm farm financial sustainability.

Table 7.1 details Australian OTC wheat bank swap returns in an anticipatory hedge for a farmer during 1996 to 2012, and compares it against a cash sale price at harvest occurring in November and a forward contract based on 10 percent protein basis (Australian Premium White wheat—APW) that was established in the March–April period.²¹ The bank swap was based on a CME wheat futures contract with a 9 percent protein, with a conversion into Australian dollars per metric tonne at the daily currency settlement rate.

There are many viewpoints on such strategy evaluations. When the OTC swap returns were added or subtracted from the physical returns from spot sales at harvest and then contrasted with the forward APW contract price that was established in the March–April period, the OTC swap strategy outperformed forward contracts in all but one year, 2011. The OTC swap strategy did not have the physical delivery risk of a forward contract, and it was able to capture any favourable local basis movement.

However, in the 12-year period 2001–2012, there were six years of swap losses for a producer, in which the swap exit price was higher than the swap entry price. Such a 50 percent success rate might be totally unacceptable for

TABLE 7.1 Australian OTC swaps, cash sales, and forward contracts: 1996–2012 (Australian dollars per metric tonne)

<i>Year</i>	<i>Short Dec. Swap Av. March–April</i>	<i>Exit Dec. Swap end November</i>	<i>Swap profit/ loss</i>	<i>Harvest spot price</i>	<i>Net sale price with swaps</i>	<i>Forward contract APW</i>	<i>Swap strategy v. forward contract</i>
1996	\$240	\$181	\$ 59	\$186	\$245	\$197	\$48
1997	\$190	\$184	\$ 6	\$177	\$183	\$163	\$20
1998	\$194	\$161	\$ 33	\$168	\$210	\$176	\$24
1999	\$175	\$133	\$ 42	\$160	\$202	\$156	\$46
2000	\$179	\$177	\$ 2	\$200	\$202	\$159	\$43
2001	\$223	\$193	\$ 30	\$220	\$250	\$199	\$51
2002	\$206	\$249	– \$ 43	\$275	\$232	\$189	\$43
2003	\$187	\$196	– \$ 9	\$190	\$181	\$173	\$ 8
2004	\$201	\$135	\$ 66	\$158	\$224	\$178	\$46
2005	\$166	\$147	\$ 19	\$150	\$169	\$158	\$11
2006	\$199	\$228	– \$ 29	\$257	\$228	\$182	\$46
2007	\$228	\$356	– \$128	\$366	\$238	\$200	\$38
2008	\$400	\$302	\$ 98	\$275	\$373	\$359	\$14
2009	\$313	\$222	\$ 91	\$215	\$306	\$294	\$12
2010	\$215	\$247	– \$ 32	\$293	\$261	\$209	\$52
2011	\$306	\$231	\$ 75	\$214	\$289	\$302	– \$13
2012	\$241	\$307	– \$ 66	\$302	\$236	\$212	\$23
Average	\$226	\$208	\$ 17	\$219	\$236	\$206	\$31

APW = Australian Premium White wheat

Source: Malcolm Bartholomaeus, 2013

a farmer wanting a successful hedge outcome most of the time. However, if a farmer only established a swap contract at prices at or above \$250 per tonne, then the OTC swap strategy would have been successful 100 per cent of the time. The problem with such a tactic was that there were only three years out of the recorded 17 years when swap entry prices were above \$250 per tonne.

Tactical entry is therefore an important consideration, as is the contango and backwardation trend. However, some periodic price volatility is required to provide farmers with pricing and financial viability opportunities.²²

Alternatively, there would have been no swap losses in any year had an OTC floor been used. The problem with an OTC floor is the premium cost, whereas there is no apparent cost of a commodity bank swap until settlement. The initial cheapness of bank swaps needs to be weighed against the probability of swap losses at settlement.

Floors. There are the usual dual advantages of floors for producers with downside price protection with buy puts combined with upside price flexibility through the physical product (Figure 6.7). These OTC pricing products for producers involve the bank buying put options on behalf of the client and combining them with currency to offer a floor price in domestic prices. All the OTC losses in Table 7.1 would have been eliminated with OTC floors. However, there is a premium cost, and rather than perceiving floors as insurance against downside price and income loss, many farmers perceive the premium cost as an unnecessary impost, particularly when there is low farm profitability.

An OTC floor strategy is distinguished from a normal buy put options hedge by a larger premium, which results in a lower floor for a producer. However, short duration floors are much cheaper than three-year floors that require several rollovers in often illiquid options markets. The premium depends on the estimated cost in rolling over positions plus a slippage risk factor for the bank. Some producers choose an even lower floor to decrease the premium by selecting a lower OTM strike price, but this increases the opportunity cost whenever prices do fall.

Rather than have the options premium as an up-front cost, the bank can deduct the premium at the expiry date of the underlying put option contract, or whenever otherwise decided upon. However, the funding of the premium will ultimately be borne by the client as an added cost.

Ceilings. These OTC pricing products involve the bank taking buy call options on behalf of end users and short merchants, and usually combining the outcome with currency risk management to provide a ceiling price in domestic denomination. There is the flexibility of upside price protection combined with downside price flexibility (Figure 6.4).

The benefit of an OTC ceiling strategy over other OTC pricing products is that it combines price protection with price flexibility. It is distinguished from a normal buy call options hedge in that the ceiling will be higher because of the added premium cost. The longer the duration, the higher will be the premium cost because of rollovers and slippage risk. However, similar to the floor strategy, the bank can deduct the premium at the expiry date of the underlying call option contract, or whenever otherwise decided upon, but the funding of the premium will ultimately be borne by the client as an added cost.

Some end users would choose an even higher ceiling to decrease the premium, by selecting a high OTM strike price. Similar to the floor strategy, this increases the opportunity cost whenever prices do rise, with price opportunities foregone until protection through the ceiling price is eventually

reached. The higher the strike price as it approaches the worst-case scenario in business operations, the more likely will the low premium and outcome probability be perceived as catastrophe insurance.

Participating forwards. The biggest disadvantage with both floors and ceilings is the premium cost, particularly with ATM strike prices. Premiums can be reduced but the trade-off usually is lower floors or higher ceilings. Alternatively, participating forwards can be designed by banks as higher floors for producers and lower ceilings for end users with no premium cost. This results in less opportunity cost.

However, there is the requirement for a 50 percent cash settlement to the bank if prices move favourably by the settlement date. In a producer example, if the futures price was \$240 per tonne, an out-of-the-money OTC floor price might be \$200 per tonne after paying a \$10 per tonne premium. This contrasts to an OTC participating forward with a floor of \$220 per tonne with no premium, thus benefitting the producer through a higher floor and less opportunity cost. If the futures price falls to \$150 per tonne, the bank pays the client \$70 per tonne at settlement. Alternatively, if the futures price rises to \$250 per tonne at the settlement date, the client is required to pay the bank \$15 per tonne, which is 50 percent of the difference between the floor price and the final settlement price.

In an end user example, if the futures price was \$240 per tonne, an out-of-the-money OTC ceiling price might be \$280 per tonne after paying a \$5 per tonne premium. This contrasts to an OTC participating forward with a ceiling of \$260 per tonne with no premium, thus benefitting the end user through a lower ceiling and less opportunity cost. If the futures price rises to \$350 per tonne, the bank pays the client \$90 per tonne at settlement. Alternatively, if the futures price falls to \$200 per tonne, the client is required to pay the bank \$30 per tonne, which is 50 percent of the difference between the ceiling price and the final settlement price.

The attractiveness of participating forwards is the zero premium and increased protection through higher floors for producers and lower ceilings for end users. Participating forwards remove many of the disadvantages associated with the high premium costs of floors and ceilings. It is a cheap strategy to manage downside risk for producers and upside risk for end users, but some flexibility to capture subsequent favourable price movement is foregone through the requirement to pay 50 percent of any favourable price movement to the bank.

OTC Collars. Collars were introduced in Chapter Six as a tactic by individual hedgers to reduce the options premiums. However, selling calls to

reduce the premium of a buy put options hedge for producers, or selling puts to reduce the premium of a buy call options hedge for end users, rarely achieves the required least-cost alignment whilst increasing the brokerage cost, particularly if currency collars are undertaken as well.

In contrast, banks can offer zero cost OTC collars to producers and end users in domestic currency denomination, despite using international futures markets.²³ The zero-cost floor for producers and zero-cost ceiling for end users in local currency is very attractive due to no premium outlay. However, the disadvantages include lower floors and higher ceilings, limited flexibility, opportunity costs, and margin settlement risk.

A short OTC collar involves a long physical market position combined with buy put and sell call positions (Figure 6.11). There must be a physical market exposure offset by two opposite options positions. The physical position combines with the buy put to establish the floor, and the sell call combines with the physical to establish a ceiling. A zero cost floor has been created for the producer, but the trade-off has been upside inflexibility due to the payoffs associated with the sell call. A short OTC collar is often combined with a long OTC currency collar to facilitate the bank offering a price in local currency to a producer or exporter.

Alternatively, a long OTC collar involves a short physical market position combined with buy call and sell put positions (Figure 6.10). Again, there must be a physical market exposure offset by two opposite options positions. The physical position combines with the buy call to establish the ceiling, and the sell put combines with the physical to establish a floor. A zero cost ceiling has been created for the end user, but the trade-off has been downside inflexibility due to the payoffs associated with the sell put. A long OTC collar is often combined with a short OTC currency collar to facilitate the bank offering a price in local currency for an end user or importer.

The OTC collar can also be differentiated from individual collars by allowing the client to automatically knock in and knock out options positions in both the commodity collar and the currency collar. A producer can knock in a buy put and sell call only if prices begin to fall, and knock out the buy put and sell call if prices begin to rise, and vice versa for currency. Premium costs will apply if the buy options positions are not offset by sell options positions.

Producer:	Price falls and currency rises: Knock in price and currency collars
	Price rises and currency falls: Knock out sell call and sell put

An end user can knock in a buy call and sell put only if prices begin to rise, and knock out the buy call and sell put if prices begin to fall, and vice versa for currency. Again, premium costs will apply if the buy options positions are not offset by sell options positions. The problem with knock in and knock out tactics is that strong trends are rare for commodity prices and currency, whereas uncertainty and volatility could dominate market movement.

End user:	Price rises and currency falls: Knock in price and currency collars
	Price falls and currency rises: Knock out sell put and sell call

Benefits of OTC bank pricing products

The most obvious advantage of OTC products to both banks and their clients is account simplification, and therefore usually lower bank fees. Working capital accounts, futures and options trading accounts, and currency accounts can be amalgamated into one single account, with savings on transaction costs. An added bonus would be if the single account lowered bank loan credit risk because of the risk management within the account.

Banks can offer clients an OTC price in local currency denomination or in an alternate currency. The OTC price is transparent for bank clients, although it has benchmarking issues in basis determination because of the lack of physical delivery.

OTC bank product bundling combined with choice and flexibility can have large advantages over other individual risk management strategies that have more complexity. There should be time saving for clients, fewer skills required, and less daily monitoring.

Banks can fund the daily settlement margins incurred in the futures market for swaps and collars for both price and currency, as well as options premiums. Combined margins and premiums are funded and then settled at OTC product maturity time against the one bank account.

Banks have no desire to receive or deliver physical agricultural product. Cash settlement of OTC pricing products favours the bank and those clients with large risk in production or delivery. Basis risk therefore remains with the client, which results in any favourable basis movement accruing to the client.

Banks sometimes have the ability to roll over a hedge for a client, or to become forward market makers, which results in being able to offer

OTC forward prices for three or more years. Forward OTC pricing will ultimately depend on market liquidity and the willingness of the bank to absorb slippage risk and transaction cost on behalf of its clients, particularly when extrapolating price as a market maker. Regardless of how the bank obtains the forward price in an illiquid market, the cost of such distant pricing will be reflected either in the OTC price or the premium.

OTC position exit flexibility is no different from normal futures and options hedging. The ability to exit OTC products at any time is a real advantage over a physical forward contract that prevents voluntary exiting of contractual obligations. A bank client might choose to exit an OTC product because of production risk, to adjust the hedge ratio as production and yields become known, or in response to expected price trends.

Because banks are acting as futures brokers, they can offer some flexibility to their clients. Whenever there is more than one liquid local or international futures exchange, clients can choose which futures exchange to base their OTC pricing. Clients can also be given choice over whether to lock in currency. Any decision not to manage currency risk involves speculation on currency movement.

The ability to knock in a floor or ceiling only when required provides OTC pricing and currency products with real tactical benefits, provided that there is market liquidity and efficient supply chain signals. Whenever settlement risk increases, the OTC instrument causing that risk can be knocked out, thus minimizing settlement payouts. The parameters of risks and rewards can be established upfront with possible scenarios, and the responsibility of discretionary managing the OTC position may be transferred from the client to the bank.

Issues with OTC bank pricing products

Despite having solved many of the problems involved with futures and options hedging, banks and their clients still encounter many issues with OTC pricing products. Tactically managing losses and balancing price protection with flexibility still remain key factors in the management of price and currency risk.

Similar to a futures trading account, the OTC client has to provide sufficient credit security to the bank for all OTC products that have final cash settlement payout risk. This is no different from other OTC products such as home loan mortgage packages. The problem for some smaller farmers is that the asset security for OTC pricing products erodes the asset base required for farm operations loan borrowing. Farm operations can then be

jeopardized by inadequate working capital, which may impact on discretionary expenditure, new investments, and new crop funding.

Banks can fund margins for the duration of the OTC product, but ultimately it is the client who has the risk of cash settlement payout at product maturity. OTC margin funding by banks removes the discipline associated with meeting daily individual margin settlements, which can lead to a false sense of security by the client and a general hope that there will be no payout.

High production risk has an uneasy relationship with cash settlement payout risk. An irrigated farmer with known production has some assurance of cash flow, albeit with dependence on physical market price. However, anticipatory dry-land agricultural production has high risks associated with final yield and cash flow that can have a serious impact on the ability to meet cash settlement payouts. The potential for OTC settlement default can be high in marginal regions, which then necessitates a bank mortgage asset sale by the bank.

Identifying costs when there is no upfront or brokerage fee can be complex. Hidden transaction costs can include wide bid: offer spreads, opportunity costs of more favourable prices forgone, premium costs deducted at settlement within an amalgamated account, and the cost of money that should include any restrictions on business as a consequence of the OTC product.

Clients are forced to use the bank-determined swap price or options premium price. There is a daily swap price per tonne for entry and exit as represented by the bid: offer spread for producers and end users. If there are no direct bank fees, the operating profit for the bank will be reflected through the bid: offer spread. The general rule for commodity bank swaps is that the client will always enter and exit at the worse swap spread price, but that is the same for currency spread rates.

Product bundling of price and currency together may be expensive, particularly when forward pricing is extended for a number of years. Each contract month roll-over usually involves slippage that then impacts on transaction costs and the OTC bid: offer spread.

Whenever price or currency flexibility is restricted, such as in swaps and collars, there can be an opportunity cost incurred by limiting favourable price movement. Potential windfall profit is foregone. Participating forwards reduce this opportunity cost to 50 percent.

Basis can only be removed when a physical transaction occurs. A bank cannot reduce or eliminate basis risk because there is no physical product delivery. Basis risk is therefore made the responsibility of the bank client, and it usually can only be minimized by the OTC bank client selecting a local or international futures exchange that has both liquidity and relevance

to local conditions. Basis risk could be high when the bank client attempts to offset their local price movement with an OTC pricing product that is based on a futures price movement that may have little relevance to local conditions and product specifications. There is final cash settlement payout risk whenever the local physical price gains do not match the OTC cash settlement losses.

OTC agricultural pricing is usually restricted to those storable products that have liquid futures markets. Illiquid forward markets for perishable products with no basis for forward pricing other than weather speculation are not conducive to the formation of an OTC bank pricing facility.

The hard lesson from OTC experience is that banks are unlikely to continue to offer OTC pricing products unless there is adequate usage by clients. Use it or lose it is a common theme for OTC agricultural pricing products, with usage having to generate sufficient profit for banks to continue offering the profit and service. Variations in seasonal and annual usage patterns of OTC pricing products makes it difficult for banks to maintain specialist staff for OTC pricing products. However, some banks offer OTC pricing products despite loss-making returns, because it is a service that can lead to other banking business.

The bank or banking regulatory authority can determine client position limits for OTC usage. End users may be allowed a position limit of 75 percent of estimated throughput required in the first year, 50 percent in the second year, and 35 percent in the third year. This is because risk increases with time for the end user. However, the risk situation should be reversed for producers. Their greatest risk is production loss in the first year. Yet producers can be permitted to cover 75 percent of their production in the first year. Producers are more likely to achieve their maximum production over a three year period, and be able to close out a favourable OTC position within that three year period. However, bank policy and regulation can limit producers to only 35 percent in the third year. There is a need for different OTC risk limit evaluations between producers and end users over a three year period.

Banks transact through futures exchanges according to the futures contract size. However, the bank might net out futures market positions as well as currency positions, and offer clients a smaller or larger standard OTC product size. Sometimes an OTC product size might be based on multiples of three futures contracts, which might favour larger hedgers over smaller hedgers.

A bank usually factors in the cost of money based on the OTC product settlement date. However, bank clients can exit OTC pricing products at

any time. If the client wants early cash settlement after exiting an OTC position, there will be an adjustment in the time value of money in terms of a payment discount.

If an international OTC product is undertaken in US dollars with pricing based on a US futures market, then daily OTC price movements will vary according to the variations in the futures market. Currency risk will still remain for the client. However, if currency is locked in for a producer, and the domestic currency falls faster relative to the fall in the US futures commodity price, then the bank swap price can actually rise and be disadvantageous for a producer at OTC settlement. Alternatively, if currency is locked in for an end user, and the domestic currency rises faster relative to the increase in the US futures commodity price, then the bank swap price can actually fall and be disadvantageous for an end user at OTC settlement.

8

TACTICS AND EVALUATION

Each selling and pricing decision of farmers directly affects merchants and end users in a deregulated supply chain. Decisions need to be made under the uncertainty of agricultural production and supply to pursue profitability. Tactics used in procurement by merchants and end users can often depend on the tactics implemented by farmers. Decisions such as how much, when, where, with whom, and how need to be decided upon either individually or within the organization.¹ However, controlling outcomes under uncertainty is difficult.²

Planning problems

Whenever plans are based on historical data that has a low probability of repeatability, planning for a future event will be flawed.³ History is a poor guide for future decision making, otherwise age, experience, and wealth would be highly correlated, which they are not. Many decisions would not be made had there been hindsight knowledge.

Successful planning depends on the amount of certainty, but the perception of certainty is often subjective, relative, and difficult to measure.⁴ The corollary suggests that the higher the uncertainty, the more likely the plan will fail, unless change and flexibility are built into the decision-making process.

Planning rarely considers psychological weaknesses in actually making decisions and the factors triggering a psychological response.⁵ Delays in psychological response can invalidate any planned decision approach.

Alternatively, an impulsive management response could jeopardize the plan from the outset.

Decision making is required to be undertaken in supply chains with insufficient information.⁶ However, information in a dynamic world is neither current nor predictive because it was based on a prior occurrence. What happened yesterday is unlikely to be repeated today, so its usefulness in decision making is very limited. It is insufficient or inaccurate information that frequently drives markets,⁷ which then requires price corrections, thus creating a price range.

As information fails to support correct decision making, there is a tendency to increase the volume of information rather than to decrease it.⁸ Making correct decisions in a world full of electronic information has become even more difficult because of all the conflicting information and vastly different interpretations of past events.⁹ This encourages the deferment of decision making and it may partially explain why private hoarding is on the increase for agricultural storable products, particularly when it is supported by improved storage technology.

Planning can attempt simple solutions under high complexity, but this can actually increase risk. Those businesses which manage currency risk and not price risk may have the delusion of simple decision making, but any adverse price movement can seriously jeopardize business operations, especially when production or sales shortfalls induce currency settlement losses. Expected balancing of losses against gains may not eventuate.

Tactical considerations

Tactics involve decision-making processes such as selection, timing, and implementation of a strategy. Knowledge of the strategy is rather meaningless if tactics are ignored.

Tactical considerations should involve the probability of outcomes combined with minimal occurrence of regret and avoidance from past decisions.¹⁰ Previous bad outcomes should not lead to future avoidance because future circumstances will be different to past events. Decision making based on anxiety, regret, avoidance, or other emotions is probably the greatest cause for mistakes in selling and pricing.

Much decision making depends on the behavioural response to the psychological consequences of the past, and can be polarized between inactiveness and being proactive. However, individual decision making can be influenced by personality type¹¹ and risk attitude psychology, as well as group psychologies.¹²

Over-confidence regarding a particular hedging strategy can lead to unnecessary or unacceptable hedging losses. Perhaps tactics such as timing were ignored. Decision making based on best and worst case scenarios for particular strategies may be far more likely to achieve the desired outcomes, especially when decisions are aligned with forward market trends.

A high hedge ratio should result from high certainty, which is what might be expected for some merchants and most end users with known procurement requirements within a twelve month period.¹³ To have a low hedge ratio with high certainty would necessitate physical speculation. Alternatively, a high hedge ratio with low certainty might result in derivative speculation. The dilemma of a performance auditor is deciding the correct trade-off between certainty and speculation in advance of an accountant with hindsight knowledge.

In contrast, a farmer balances certainty against uncertainty for the duration of production.¹⁴ There is a high probability that any certainty could revert to uncertainty very quickly. What is deemed conservative today with a low hedge ratio might be perceived tomorrow as reckless with a high hedge ratio and derivative speculative exposure because of crop failure. Drought or tempest can decrease yield rapidly. Dry-land farmers with a disposition to managing price risk may have relatively low hedge ratios.¹⁵

Both buyers and sellers frequently target a price based on their cost of operations plus a comparable profit margin.¹⁶ The irony is that when they enter a supermarket to buy, they ignore the cost of production and farmer profit margins. Nationalistic sentiment and increased trade protection policies are unlikely to alter the basic tenets of consumer behaviour of wanting the highest value for the lowest possible price. It is only on the very rarest of occasions that buyers will pay more than the perceived value.

Target pricing must be based on market reality. Operating costs must be minimized to allow more flexibility to target a price within the normal range of market price movement. The probability of achieving a price outside the normal price range is very low, given the historical skewness of agricultural commodity prices and their trends.

There is some evidence that knowledge of operating costs can lead to managing price risk.¹⁷ What may be more pertinent is that knowledge of the cost of operations may lead to improved cost control, which is more likely to lead to realistic target pricing and price risk management. There may be an association between cost and pricing, but it is more likely to occur through cost control and selecting more realistic pricing targets.

From a tactical perspective in an efficient supply chain, forward market information is rather meaningless unless the direction of intermonth price

movement is known, such as whether carry or backwardation is increasing or decreasing. Farmers would be more likely to hedge if backwardation was consistently decreasing or carry increasing, whereas end users would be more likely to hedge if carry was decreasing or backwardation increasing.

It is relatively easier and less risky for a farmer to roll over a hedge or extend a scheduled physical delivery to a future time in an increasing contango market than it is in an increasing backwardation market.¹⁸ There is a higher probability of a large margin settlement or physical default from the farmer in an increasing backwardation market.

Many seemingly good decisions fail because the timing is wrong.¹⁹ Poor timing can result in direct transaction costs, indirect opportunity costs, and unacceptable losses. Given another time and circumstance, the objective might be achieved.²⁰ Decision making over timing with both choice and flexibility of strategy can be far more important than understanding the previous performance of a hedging strategy.²¹

Timing the exit of a strategy may be just as crucial as the entry. Exit tactics can be based on worst case scenarios, particularly when such exiting involves a cash settlement. Price risk management strategies that require a final cash settlement include defaulted forward contracts, bank swaps, participating forwards, and OTC collars.²²

Persistent price skewness makes it imperative for farmers to take advantage of any higher price opportunity, even if it is seasonal.²³ The problem with linking seasonal periods to implementation of price risk management strategies is that predictability can lead to illiquidity.²⁴ If everyone thought prices were going to rise, prices would gap upwards into a spike. Alternatively, if everyone thought prices were going to fall, prices would gap downwards into a price collapse.

Whilst there needs to be regular monitoring of market changes so that decisions can be adjusted, there is the real danger of too frequent adjustments to decision making that might only benefit advisers and brokers.²⁵ An end user who has known input supply requirements would have little need to adjust the hedge ratio. A dry-land farmer who has a low hedge ratio based on production uncertainty is likely to only periodically adjust the hedged amount according to production conditions.²⁶ Perhaps an irrigated farmer might vary the hedge ratio based on changed agronomic conditions and water availability.

In contrast, a merchant with alternating market positions involving dynamic inventory and different transaction orders is more likely to adjust hedge net exposures regularly, if not daily.²⁷ A net short position might be reversed to a net long position with one phone call. Flexibility in decision

making is required to manage such position reversals.²⁸ The managerial ability and organizational capability to manage these price exposures may determine the long term financial viability of the merchant.

It can be argued that there has never been a recent financial disaster with a strategy that has flexibility, such as buying options for a premium cost. However, there have been numerous financial disasters that have been due to physical speculation or using inflexible strategies such as locking in price, currency, or interest rates.²⁹ If flexibility is not adopted, then there needs to be greater emphasis on tactics such as strategy entry and exiting to prevent unnecessary losses.³⁰

Management of price risk is not about maximizing profit, which explains why hoarders and those with high debt and costs have little interest in managing price.³¹ Price risk management will never achieve the best price either for a farmer or an end user because of transaction costs, opportunity costs, slippage, illiquidity, indecisive decision making, or when forward prices are inverted into backwardation for farmers. However, the desire to maximize profit rarely achieves satisfactory outcomes for those who actively seek it.³²

The management of price risk is focused on managing or minimizing financial losses. There needs to be an acceptance that some losses are inevitable on the pathway to profitability. The ability to manage a difficult loss situation contrasts to the luck that sometimes occurs in good times when profits are made. Luck has the habit of reflecting success, but it usually does not indicate good management. Such opportunity windfalls are likely to be soon lost in downturns.³³

Uncertainty and associated risk trade-offs can increase the probability of unfavourable outcomes from some risk management strategies, which may overwhelm an already high risk business.³⁴ This has important credit risk implications for bank managers, particularly when choosing fixed rather than more flexible strategies for their customers. Such outcomes may suggest that management of price and currency risk might only be suitable for those businesses with already low to medium risk, and exclude those with high risk. Dry-land grain growers with high production risk may be reluctant to undertake price risk management,³⁵ in contrast to irrigated cotton farmers who may be more willing to undertake price risk management because they have low production risk.³⁶

Much of the cost of inflexible risk management strategies accrues from the opportunity cost of money, the loss of cash flow, the tying up of vital operating capital, the possible need for increased debt, and opportunity losses.³⁷ In contrast, flexible pricing strategies can avoid much of the

opportunity costs and losses in lieu of a single premium cost. Brokerage fees are generally minimal in the management of price and currency risk.

More market liquidity results in greater ability to offset risk with low transaction costs through narrow bid: offer spreads. Less market liquidity results in little ability to offset risk and much higher transaction costs that are caused by slippage in wide bid: offer spreads.³⁸ Choosing more liquid markets can decrease transaction costs, which explains the greater usage of some US and European futures exchanges.³⁹

From a tactical perspective, decision making for farmers can be divided into three phases. There is the physical production phase which is anticipatory and speculative with the dilemma over whether to forward sell or implement a pricing strategy.⁴⁰ Then there is the harvest period in which both production and price risk are known, and the only decision is to sell or not to sell.⁴¹ For some farmers, however, there is a third and final stage of storage or pooling in which quantity is known but selling and pricing are uncertain.⁴²

Preharvest considerations

At the same time that end users and merchants are generating cash flow with old crop, farmers are more likely to be establishing a market position for new crop and expending cash flow on seed, fertilizer, and fuel.⁴³ A long market position with downside price risk is established as soon as farmers make the first new crop expenditure. Farm debt is thus likely to rise at a time of increasing price exposure.

Farmers often are tempted to make decisions regarding pricing before planting despite the uncertainty of final production. Geographical latitude for some farmers might provide the advantage that their highest price for the year occurs prior to planting. It might be that local prices are high because of no harvesting pressures. Much depends on the sensitivity of local to international prices as measured by basis movement.⁴⁴

Product uncertainty frequently reduces farm output to commodity status because of an inability to integrate with supply chains, which causes price risk exposure during the production phase. Whilst the vast majority of farmers do not deliberately choose to produce a price-taking undifferentiated commodity, especially given the array of product differentiation attributes such as grain with different milling, flour, dough, and starch characteristics, the end result reality is that much of what is finally produced is not directly needed or cannot be transformed into a

consumer-demanded product.⁴⁵ The largest single grain market often is the animal feed or starch market.

It is in the interests of niche merchants to be active in the period before harvest to lock in specific supplies for end users. Price premiums for specified commitments prior to harvest might be contrasted with price discounts for surpluses and quality deterioration after harvest. There is pressure on farmers to forward sell, despite the uncertainty of both yield and final product attributes as well as the risk of contract default.

The agricultural dilemma is that the greater the specificity of product attributes for contract delivery, the higher might be the probability of contract default.⁴⁶ A merchant may seek to counter this problem by sourcing supply from regions with higher certainty or to spread supply over many districts to lower the risk of supply default, but this introduces categorization of regional and locality risk that can further commoditize farm output.

Doing nothing with pricing and selling in the preharvest period is a very legitimate strategy provided that all the prerequisite decision-making processes are undertaken. All alternate strategies need to be evaluated against the forward market contango and backwardation trends.⁴⁷ The worst situation for a farmer, merchant, or end user is deciding to do nothing simply because there was no time or they did not have the required skills or management.⁴⁸ A decision to defer doing anything may appear simple until markets and circumstances change, with risks increasing and much subsequent regret.⁴⁹

If carry was decreasing or backwardation increasing, a farmer or long merchant might decide to do nothing because the probability of hedge losses due to rising prices might be too high. However, there still has to be consideration as to the decisions required if carry began to increase or backwardation started to decrease, thereby increasing the downside price risk. Doing nothing for a farmer might be evaluated against a buy put options hedge that would provide flexibility no matter which direction prices moved.

Alternatively, if carry was increasing or backwardation decreasing, an end user or short merchant might decide to do nothing because the probability of hedge losses due to falling prices might be too high. Similarly, there still has to be consideration as to the decisions required if carry began to decrease or backwardation started to increase. Doing nothing for an end user might be evaluated against a buy call options hedge that would provide flexibility no matter which direction prices moved.

Harvest period issues

Product uncertainty decreases as harvesting progresses whilst price risk increases. Yield becomes known and delivery default risk decreases, but uncertainties may remain over product attributes and specification risk until product transformation occurs through end usage.⁵⁰

To sell or not to sell is the dilemma for some farmers at harvest time, much to the chagrin of merchants and end users who are anxious to secure available product that meets their specification.⁵¹ Buyer activity is maximized at harvest time and buyer competition is likely to bid up prices even though there are increasing supplies available. Prices can fall depending on when harvest time occurs relative to other regions, however, any attempt by farmers to limit buyer competition at harvest time through uncooperative activity generally decreases the opportunity for higher prices, especially when buyers can purchase from alternate sources of supply.

Many factors can influence a decision to sell at harvest time, such as the product type and its storability, intake congestion, and the expected propensity for prices and basis to rise after harvest. Many products such as sugar cane and tea require immediate processing because of product deterioration, with delivery perhaps necessitating the loss of product ownership despite often retaining the price risk.⁵²

Buyers often need to carefully select product at harvest time based on desirable end usage attributes. This buyer discrimination tends to aggravate farmer-merchant relationships⁵³ but it is due to the constraints of product transformation capabilities and specific consumer needs, which are not going to be removed by collectivization or government intervention.

Buyer rejection of product and price at harvest time can result in emotional trauma, despondency, and anxiety for farmers, which can often lead to either depression or anger.⁵⁴ Farmer resentment after such a major production effort can frequently lead to deferment of selling and pricing, which can then introduce many postharvest issues.

Selling and pricing decisions at harvest need to be undertaken when there are serious time constraints, often with sleep deprivation. Weather conditions can further aggravate the already tense situation for farmers. Transport and labour shortages, intake congestion, and long queues to unload can often influence farmer decisions to sell or to defer any sale. The paradox is that product differentiation and higher prices depend on laboratory testing, long waiting times, and product segregation, whereas nonsegregated commoditization may improve product intake and delivery efficiency but at lower prices.

Banks, input suppliers, and creditors cannot be repaid without the cash flow from selling product. In contrast, a hoarder foregoes cash flow and defers payment to banks, input suppliers, and creditors, thus incurring debt repayment interest, the cost of money with cash flow foregone, and the loss of goodwill to suppliers and contractors. A farmer who has not repaid a harvesting contractor from the previous year is unlikely to have contractors for the following harvest.

Postharvest problems

The ability to defer sales after harvest or maturity is not a choice for non-storable products such as meat and milk. Some products can be commingled more easily than others, such as grains and oilseeds for volume commodity sales,⁵⁵ but this may not suit end users who want product differentiation, origination, identity preservation, segregation, or traceability.

Many farmers go to extraordinary efforts during the production phase to differentiate their biological heterogenic products only to have them commingled and pooled after harvest to achieve uniformity, conformity, and postharvest efficiency. Desirable product attributes that can create both comparative and competitive advantages are lost through product averaging. Postharvest commingling problems include cross-segregation issues, blending failures, loss of identity preservation, product deterioration, price and currency risk, moisture loss, and opportunity costs including the time value of money. Postharvest problems will be discussed further in Chapter Nine.

One alternative to postharvest hoarding or pooling is a cash sale with cash flow benefits combined with the ability to enhance price through buy call options. Having a relevant liquid options market enables the potential for price enhancement that could replace any desire for longer term hoarding or for spreading sales over time through commodity pooling.

Producer and long merchant strategy evaluation

Selling and pricing strategies for long physical market positions will be evaluated over a range of prices, based on the price range of \$100 to \$1400 in Table 6.1 with the current price being \$700. The profit and loss for each instrument (P/L) will be calculated and then added or subtracted with the market price to obtain the realized price of the strategy (RP). It will be assumed that there is no basis or basis movement, with the spot physical price equaling the spot futures price.

Table 8.1 evaluates five groupings of strategies for a producer or long merchant based on the following characteristics:

Group 1 strategy. Do no preharvest selling or pricing and sell in the spot cash market at harvest time. The realized price here equates to the spot market price.

Group 2 strategies. Fixed price strategies are established at \$700, which include a fixed price forward contract, a short futures hedge, a short over-the-counter swap, or a hedged-to-arrive contract (also known as a futures first contract). The realized price, which combines the profit and loss of the instrument with the market price, equates to the fixed price in the absence of basis movement.

Group 3 strategies. A floor price strategy with a buy put option is established at a strike price of \$600 with a cost or discount of \$70, which includes a buy put options hedge, an over-the-counter floor, an over-the-counter participating forward, or a minimum price forward contract (on the assumption that the merchant took out a buy put option and gave the physical upside benefit to the seller). The realized price, which combines the profit and loss of the instrument with the market price, equates to the floor price of \$530 with upside gain above \$600.

Group 4 strategies. A price enhancement strategy is established which either includes a fixed price forward contract at \$700 plus a buy call option at a strike price of \$900 with a cost of \$50, or a spot cash market sale at harvest time at \$700 plus a buy call option at a strike price of \$900 with a cost of \$50. The realized price, which combines the profit and loss of the fixed price instrument with the profit and loss of the buy call option, and the net profit and loss are then combined with the market price, which equates to a floor price of \$650 with upside gain above \$900.

Group 5 strategy. Short collar is established with a buy put at strike price of \$600 and a premium cost of \$70 combined with a sell call at strike price of \$900 for premium of \$50. The realized price, which combines the profit and loss of the buy put option with the profit and loss of the sell call option, and the net profit and loss are then combined with the market price, which equates to a floor price of \$580 and a ceiling of \$880.

The realized prices from the five groups of strategies are graphed against market price in Figure 8.1 to determine the best strategy over a range of

TABLE 8.1 Profit and loss profile for producer and long merchant strategies

Market Price (1)		Fixed Price Strategies (2)		Floor Price Strategies (3)		Price Enhancement (4)				Short Collar (5)			
P/L		P/L	RP	P/L	RP	P/L fixed	P/L call	Net P/L	RP	P/L put	P/L call	Net P/L	RP
100	-600	+600	700	+430	530	+600	-50	+550	+650	+430	+50	+480	580
200	-500	+500	700	+330	530	+500	-50	+450	+650	+330	+50	+380	580
300	-400	+400	700	+230	530	+400	-50	+350	+650	+230	+50	+280	580
400	-300	+300	700	+130	530	+300	-50	+250	+650	+130	+50	+180	580
500	-200	+200	700	+30	530	+200	-50	+150	+650	+30	+50	+80	580
600	-100	+100	700	-70	530	+100	-50	+50	+650	-70	+50	-20	580
700	0	0	700	-70	630	0	-50	-50	+650	-70	+50	-20	680
800	+100	-100	700	-70	730	-100	-50	-150	+650	-70	+50	-20	780
900	+200	-200	700	-70	830	-200	-50	-250	+650	-70	+50	-20	880
1000	+300	-300	700	-70	930	-300	+50	-250	+750	-70	-50	-120	880
1100	+400	-400	700	-70	1030	-400	+150	-250	+850	-70	-150	-220	880
1200	+500	-500	700	-70	1130	-500	+250	-250	+950	-70	-250	-320	880
1300	+600	-600	700	-70	1230	-600	+350	-250	+1050	-70	-350	-420	880
1400	+700	-700	700	-70	1330	-700	+450	-250	+1150	-70	-450	-520	880

(P/L = Profit/Loss; RP = Realized Price)

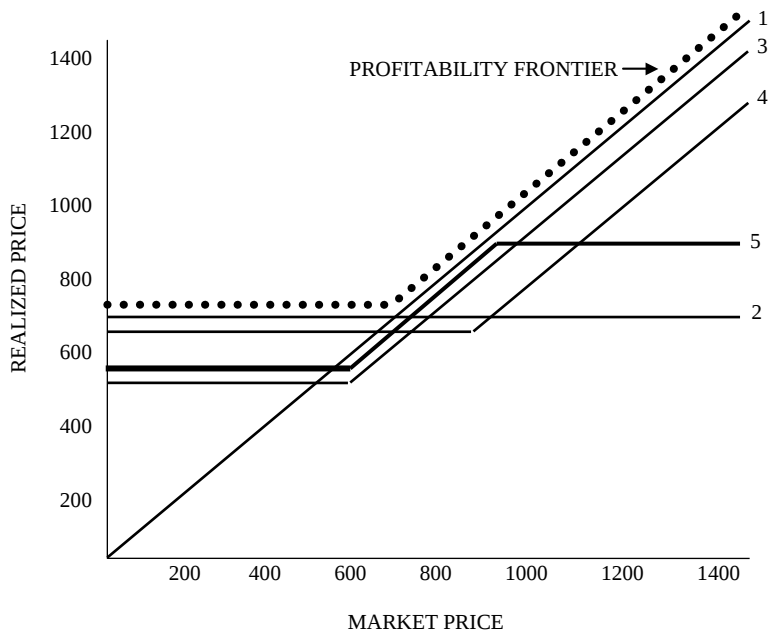


FIGURE 8.1 Profitability frontier for producer and long merchant strategies

market prices, using profitability profiling. A profitability frontier can then be drawn, which determines the strategy with the highest realized price for each market price.

If market prices fell below \$700 in a what-if analysis, then the best strategy for a producer or long merchant based on the profitability frontier is any strategy that locks in a price (Group 2 strategies). This agrees with the old adage, which is to lock prices in when they are moving adversely, but this assumes that production is relatively certain.

Alternatively, if market prices rose above \$700 in a what-if analysis, then the best strategy for a producer or long merchant based on the profitability frontier is not doing any prior selling or pricing, and just sell into spot cash market at harvest time (Group 1 strategy), especially if production is relatively uncertain.

If market prices are uncertain, or if production is uncertain, then buy put options may be the best strategy prior to harvest (Group 3 strategies). It is not the best strategy when there is strong market price direction, but it may be the best strategy prior to harvest when there is uncertainty either over price or production. The problem with a strategy that provides both a floor and upside flexibility is the cost of the premium.

Price enhancement necessitates a prior fixed price strategy, either a fixed price forward contract prior to harvest or a cash sale at harvest. To avoid regret over the fixed price decision or to take advantage of possible upside potential after prices are locked in, prices can be enhanced through buying call options (Group 4 strategies). There is a premium cost of the buy call that can be adjusted according to the selected strike price, but this can be funded by the delivery settlement or a cash sale at harvest time. The cash sale at harvest plus a buy call option strategy replaces the need for a speculative storage or hoarding strategy, on the assumption that there is a relevant and liquid options market available.

The short collar (Group 5 strategy) with a combined floor and ceiling has only been introduced to lessen the cost of the buy put options in the Group 3 strategies. A short collar limits the upside gain of a floor strategy because of the sell call option that incurs margin losses above the strike price that need to be offset by physical gains. However, if prices were rising or if production was uncertain, the sell call could be knocked out leaving the floor intact, but this increases the overall cost of the strategy.

End user and short merchant strategy evaluation

Buying and pricing strategies for short physical market positions will be evaluated over a range of prices, based on the price range of \$100 to \$1400 in Table 6.1 with the current price being \$700. The profit and loss for each instrument (P/L) will be calculated and then added or subtracted with the market price to obtain the realized price of the strategy (RP). It will be assumed that there is no basis or basis movement, with the spot physical price equaling the spot futures price.

Table 8.2 evaluates five groupings of strategies for an end user or short merchant based on the following characteristics:

Group 1 strategy. Do no forward buying or pricing and buy in the spot cash market when product is required. The realized price here equates to the spot market price.

Group 2 strategies. Fixed price strategies are established at \$700, which include a fixed price purchase contract, a long futures hedge, or a long over-the-counter swap. The realized price, which combines the profit and loss of the instrument with the market price, equates to the fixed price in the absence of basis movement.

Group 3 strategies. Ceiling price strategies with a buy call option are established at a strike price of \$900 with a cost or discount of \$50, which

includes a buy call options hedge, an over-the-counter ceiling, an over-the-counter participating forward, or a maximum price forward contract (on the assumption that the merchant took out a buy call option and gave the physical downside to the seller). The realized price, which combines the profit and loss of the instrument with the market price, equates to the ceiling price of \$950 with downside gain below \$900.

Group 4 strategies. Price enhancement strategies are established that include either a fixed price forward contract at \$700 plus a buy put option at a strike price of \$400 with a cost of \$20, or a spot cash market purchase at \$700 plus a buy put option at a strike price of \$400 with a cost of \$20. The realized price, which combines the profit and loss of the fixed price instrument with the profit and loss of the buy put option, and the net profit and loss are then combined with the market price, which equates to a ceiling price of \$720 with downside gain below \$400.

Group 5 strategy. A long collar is established with a buy call at strike price of \$900 and a premium cost of \$50 combined with a sell put at strike price of \$400 for premium of \$20. The realized price, which combines the profit and loss of the buy call option with the profit and loss of the sell put option, and the net profit and loss are then combined with the market price, which equates to a ceiling price of \$930 and a floor of \$430.

The realized prices from the five groups of strategies are graphed against market price in Figure 8.2 to determine the best strategy over a range of market prices, using profitability profiling. A profitability frontier can then be drawn, which determines the strategy with the lowest realized price for each market price.

If market prices rose above \$700 in a what-if analysis, then the best strategy for an end user or short merchant based on the profitability frontier is any strategy that locks in a price (Group 2 strategies). This agrees with the old adage, which is to lock prices in when they are moving adversely.

Alternatively, if market prices fell below \$700 in a what-if analysis, then the best strategy for an end user or short merchant based on the profitability frontier is not doing any prior buying or pricing and just buying in the spot cash market when needed (Group 1 strategy).

If market prices are uncertain, then buying call options may be the best strategy prior to purchasing (Group 3 strategies). It is not the best strategy when there is strong market price direction, but it may be the best strategy prior to purchasing when there is uncertainty over price. The problem with such a strategy that provides both a ceiling and downside flexibility is the cost of the premium.

TABLE 8.2 Profit and loss profile for end user and short merchant strategies

Market Price (1)		Fixed Price Strategies (2)		Ceiling Price Strategies (3)		Price Enhancement (4)				Long Collar (5)			
P/L		P/L	RP	P/L	RP	P/L fixed	P/L put	Net P/L	RP	P/L call	P/L put	Net P/L	RP
100	+600	-600	700	-50	150	-600	+280	-320	420	-50	-280	-330	430
200	+500	-500	700	-50	250	-500	+180	-320	520	-50	-180	-230	430
300	+400	-400	700	-50	350	-400	+80	-320	620	-50	-80	-130	430
400	+300	-300	700	-50	450	-300	-20	-320	720	-50	+20	-30	430
500	+200	-200	700	-50	550	-200	-20	-220	720	-50	+20	-30	530
600	+100	-100	700	-50	650	-100	-20	-120	720	-50	+20	-30	630
700	0	0	700	-50	750	0	-20	-20	720	-50	+20	-30	730
800	-100	+100	700	-50	850	+100	-20	+80	720	-50	+20	-30	830
900	-200	+200	700	-50	950	+200	-20	+180	720	-50	+20	-30	930
1000	-300	+300	700	+50	950	+300	-20	+280	720	+50	+20	+70	930
1100	-400	+400	700	+150	950	+400	-20	+380	720	+150	+20	+170	930
1200	-500	+500	700	+250	950	+500	-20	+480	720	+250	+20	+270	930
1300	-600	+600	700	+350	950	+600	-20	+580	720	+350	+20	+370	930
1400	-700	+700	700	+450	950	+700	-20	+680	720	+450	+20	+470	930

(P/L = Profit/Loss; RP = Realized Price)

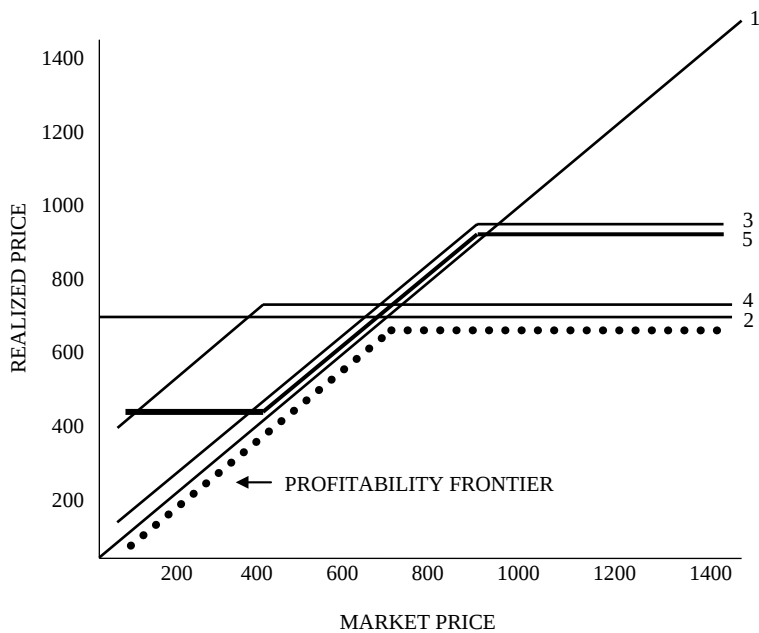


FIGURE 8.2 Profitability frontier for end user and short merchant strategies

Price enhancement necessitates a prior fixed price strategy, either a fixed price purchase contract or a purchase in the spot cash market. To avoid regret over the fixed price decision or to take advantage of possible downside potential after prices are locked in, prices can be enhanced through buying put options (Group 4 strategies). There is a premium cost of the buy put that can be adjusted according to the selected strike price.

The long collar (Group 5 strategy) with a combined ceiling and floor has only been introduced to lessen the cost of the buy call options in Group 3 strategies. A long collar limits the downside gain of a ceiling strategy because of the sell put option that incurs margin losses below the strike price that need to be offset by physical purchase gains. However, if prices were falling, the sell put could be knocked out leaving the ceiling intact, but this increases the overall cost of the strategy.

Strategy matrices

There are many factors which can influence strategy selection.⁵⁶ Various approaches can be used to analyze the advantages and disadvantages of each strategy to assist in decision making.⁵⁷ Table 8.3 uses a matrix to examine

TABLE 8.3 Matrix of major strategies against management factors

<i>User factor</i>	<i>Market price</i>	<i>Fixed price contract</i>	<i>Futures hedge</i>	<i>OTC swap</i>	<i>Floor/ ceiling</i>	<i>Price enhancement</i>	<i>OTC collar</i>
Price protection	No	Yes	Yes	Yes	Yes	Yes	Yes
Price flexibility	Yes	No	No	No	Yes	Yes	Limited
Basis risk	Yes	No	Yes	Yes	Yes	No	Yes
Currency risk	Yes	No	Yes	Maybe	Maybe	No	Maybe
Delivery risk	No	Yes	No	No	No	No	No
Settlement/ margin risk	No	Yes	Yes	Yes	No	No	Yes
Credit security required	No	No	Yes	Yes	No	No	Yes
Premium cost	No	No	No	No	Yes	Yes	No

a number of management factors against groups of strategies to create a profile for each strategy group. Fixed priced strategies have been split into physical forward contracts, futures hedging, and OTC swaps because of major differences.

All strategies have price protection except for selling or buying in the spot cash market. However, all fixed price strategies such as physical forward contracts, futures hedging, and OTC swaps are inflexible regarding price movement, which contrasts with spot cash transactions, floors, ceilings, and price enhancement. Collars have limited flexibility because of the floor-ceiling combination.

The strategies that do not have margin risk or settlement credit risk are the spot market price, floors, ceilings, and price enhancement. Futures hedging has daily margin risk, while forward contracts have cash-settled default risk, whereas OTC swaps and collars have final cash settlement risk.

Basis and currency risk remains with all strategies unless specifically locked in with a flat price with a commitment to physically deliver or accept delivery of the product. A forward contract and a price enhancement strategy lock in both basis and currency because they require delivery or taking delivery. OTC swaps, floors, ceilings, and collars have the choice of locking in currency, but not basis because they are nondeliverable contracts.

Financial asset security through initial margins is required for futures hedging, whereas mortgage asset security or a working account is required for OTC swaps and collars. Forward contracts do not have asset security.

TABLE 8.4 Matrix of merchant strategies against management factors

<i>Customer factor</i>	<i>Minimum price contract</i>	<i>Maximum price contract</i>	<i>Basis contract</i>	<i>Hedged-to-arrive contract</i>	<i>Deferred price contract</i>	<i>Supply contract</i>	<i>Storage contract</i>
Price protection	Yes	Yes	No	Yes	No	No	No
Price flexibility	Yes	Yes	Yes	No	Yes	Yes	Yes
Basis risk	No	No	No	Yes	Yes	Yes	Yes
Currency risk	No	No	Yes	No	Yes	Yes	Yes
Delivery risk	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Settlement/ margin risk	Yes	Yes	No	Yes	No	No	No
Credit security required	No	No	No	No	No	No	No
Premium/ discount cost	Yes	Yes	No	No	No	No	No

Merchant strategies. A matrix of merchant strategies can include a range of both fixed and flexible pricing products for sellers and buyers (Table 8.4). Minimum price forward contracts for sellers combine a fixed price forward contract with a buy call which provides the upside gain. Alternatively, maximum price forward contracts for buyers combine a fixed price forward contract with a buy put which provides the downside gain. The advantage of both minimum and maximum forward contracts is that they combine price protection with price flexibility whilst locking in both currency and basis, however they do require delivery and incur settlement risk if there is delivery default.

The traditional basis contract locks in only basis upfront, and defers locking in futures and currency to a later date. If futures and currency have not been locked in by the delivery date, then the merchant will provide a flat price on the delivery day. In contrast, a Hedged-to-Arrive (HTA) contract locks in futures and currency upfront, and defers locking in basis, but the merchant will determine basis on the delivery day if not decided beforehand.

A deferred price contract allows the locking in of futures, currency, and basis at any time during the life of the contract. If any component has not been locked in by the delivery date, then the merchant will provide a flat price on the delivery day. This contrasts with a supply contract in which the seller does not have the choice of component pricing but must take the spot cash price on the delivery day.

TABLE 8.5 Seller strategy suitability under varying forward market conditions

<i>Seller strategy</i>	<i>Increasing contango</i>	<i>Decreasing contango</i>	<i>Increasing backwardation</i>	<i>Decreasing backwardation</i>	<i>Price uncertainty</i>
Spot cash market	x	✓	✓	x	x
Fixed price contract	✓	x	x	✓	✓
Short futures hedge	✓	x	x	✓	✓
OTC short swap	✓	x	x	✓	✓
Floor	✓	✓	✓	✓	✓
Price enhancement	x	✓	✓	x	x
OTC short collar	✓	x	x	✓	✓
Minimum price contract	✓	✓	✓	✓	✓
Basis contract	x	✓	✓	x	x
Hedged-to-arrive contract	✓	x	x	✓	✓
Deferred price contract	x	✓	✓	x	x
Supply contract	x	✓	✓	x	x
Storage contract	x	✓	✓	x	x

Storage contracts usually do not involve any pricing because ownership title transfer does not occur. Whilst physical delivery must occur, the essence of the contract is in the storage and the cost borne by the product owner. There may be a sale at a later date, but this is not made mandatory in the storage contract.

Forward market seller matrix. Table 8.5 compares the suitability of all the seller strategies against varying conditions in the forward market, such as increasing and decreasing contango and backwardation conditions. It then compares the seller strategies against price uncertainty.

The two strategies that consistently satisfy every requisite for the seller in terms of price protection whilst maintaining price flexibility even under price uncertainty are the flexible floor with no delivery requirements and the minimum price forward contract that does require physical delivery.

Both provide price protection and flexibility regardless of the price trend, which can best be described as achieving the best of both worlds.

All the other strategies have varying disadvantages regarding price risk and inflexibility. In general terms, many strategies may provide price protection but not price flexibility. Others provide for price flexibility but do not protect price. Very few combine both flexibility and protection.

If prices are uncertain, the general rule for a seller is to avoid those strategies with no price protection, such as spot transactions including price enhancement, basis contracts, and deferred pricing contracts including supply and storage contracts. Strategies that provide protection under price uncertainty include those that either lock in prices such as fixed-priced contracts, short futures hedge, short swaps, and hedged-to-arrive contracts, or floor strategies that include minimum price contracts and short collars.

Forward market buyer matrix. Table 8.6 compares the suitability of all the buyer strategies against varying conditions in the forward market, such as increasing and decreasing contango and backwardation conditions, as well as market uncertainty. Again the buyer strategies are evaluated against price uncertainty.

TABLE 8.6 Buyer strategy suitability under varying market conditions

<i>Buyer strategy</i>	<i>Increasing contango</i>	<i>Decreasing contango</i>	<i>Increasing backwardation</i>	<i>Decreasing backwardation</i>	<i>Price uncertainty</i>
Spot cash market	✓	x	x	✓	x
Fixed price purchase contract	x	✓	✓	x	✓
Long futures hedge	x	✓	✓	x	✓
OTC long swap	x	✓	✓	x	✓
Ceiling	✓	✓	✓	✓	✓
Price enhancement	✓	x	x	✓	✓
OTC long collar	x	✓	✓	x	✓
Maximum price contract	✓	✓	✓	✓	✓
Basis contract	✓	x	x	✓	x
Deferred price contract	✓	x	x	✓	x
Supply contract	✓	x	x	✓	x

The two strategies that again consistently every requisite for the buyer in terms of price protection whilst maintaining price flexibility even under price uncertainty are the flexible ceiling with no delivery requirements and the maximum price forward contract that requires physical delivery. Both provide price protection and flexibility regardless of the price trend, which can best be described as achieving the best of both worlds.

All the other strategies have varying disadvantages regarding price risk and inflexibility. In general terms, many of those strategies that protect price do not provide for price flexibility. Others provide for price flexibility but do not protect price. Very few combine both flexibility and protection.

If prices are uncertain, the general rule for a buyer is to avoid those strategies with no price protection, such as spot transactions, basis contracts, and deferred pricing contracts that can include supply contracts. Strategies that provide protection under price uncertainty include those that either lock in prices such as fixed-priced contracts, long futures hedge, long swaps, or ceiling strategies that include maximum price contracts and long collars.

Price enhancement strategies are differentiated between sellers and buyers. Whereas a farmer would defer forward selling or pricing in price enhancement until harvest time, and then take out a buy call option, the end user locks in immediately and then uses a buy put option to enhance price.

TABLE 8.7 Seller strategy suitability under varying basis and currency conditions

<i>Seller strategy</i>	<i>Improving basis</i>	<i>Worsening basis</i>	<i>Improving currency</i>	<i>Worsening currency</i>	<i>Basis and currency uncertainty</i>
Spot cash market	✓	x	✓	x	x
Fixed price contract	x	✓	x	✓	✓
Short futures hedge	✓	x	✓	x	x
OTC short swap	✓	x	x	✓	x
Floor	✓	x	✓	x	x
Price enhancement	x	✓	x	✓	✓
OTC short collar	✓	x	x	✓	x
Minimum price contract	x	✓	x	✓	✓
Basis contract	x	✓	✓	x	x
Hedged-to-arrive contract	✓	x	x	✓	x
Deferred price contract	✓	x	✓	x	x
Supply contract	✓	x	✓	x	x
Storage contract	✓	x	✓	x	x

Basis and currency matrix for sellers. Table 8.7 compares the suitability of all the seller strategies against varying basis and currency conditions, as well as uncertainty. It will be assumed that OTC products lock in both futures and currency, and that a floor strategy does not lock in currency.

No one strategy consistently meets every market condition for the seller regarding basis and currency trends or directional uncertainty. In general terms, those strategies which are advantaged by favourable basis and currency trends are disadvantaged by unfavourable basis and currency trends. There is no best of both worlds in terms of having basis and currency trend flexibility. Locking in a flat price could prevent subsequent favourable basis or currency trends, while establishing a floor could have exposure to unfavourable basis or currency trends.

The two strategies which perform best under basis and currency uncertainty are the fixed price forward contract which locks in all the components of price through a fixed flat price, and a minimum price forward contract that establishes a floor price but which locks in both basis and currency. However, both of these very different strategies require physical delivery and cannot be undertaken when there is uncertainty over production, product specification, and delivery. Either an end user or merchant can offer the fixed price contract, whereas the minimum price contract can only be offered by a merchant.

TABLE 8.8 Buyer strategy suitability under varying basis and currency conditions

<i>Buyer strategy</i>	<i>Improving basis</i>	<i>Worsening basis</i>	<i>Improving currency</i>	<i>Worsening currency</i>	<i>Basis and currency uncertainty</i>
Spot cash market	✓	x	✓	x	x
Fixed price purchase contract	x	✓	x	✓	✓
Long futures hedge	✓	x	✓	x	x
OTC long swap	✓	x	x	✓	x
Ceiling	✓	x	✓	x	x
Price enhancement	x	✓	x	✓	✓
OTC long collar	✓	x	x	✓	x
Maximum price contract	x	✓	x	✓	✓
Basis contract	x	✓	✓	x	x
Deferred price contract	✓	x	✓	x	x
Supply contract	✓	x	✓	x	x

Basis and currency matrix for buyers. Table 8.8 compares the suitability of all the buyer strategies against varying basis and currency conditions, as well as uncertainty. It will be assumed that OTC products lock in currency, and that a ceiling strategy does not lock in currency.

Again, no one strategy consistently meets every market condition for the buyer regarding basis and currency trends or directional uncertainty. In general terms, those strategies which are advantaged by favourable basis and currency trends are disadvantaged by unfavourable basis and currency trends. There is no best of both worlds in terms of having basis and currency trend flexibility. Locking in a flat price could prevent subsequent favourable basis or currency trends, while establishing a ceiling could have exposure to unfavourable basis or currency trends.

There are three strategies which perform best under basis and currency uncertainty. These are the fixed price purchase contract which locks in all the components of price through a fixed flat price, and the maximum price forward contract and the price enhancement strategy which can be structured the same but administered differently, and which lock in both basis and currency. All of these strategies require physical delivery.

A fixed price contract could be offered by either a merchant or a producer. However, it is usual for only a merchant to offer the maximum price contract that is structured by adding a buy put option to the fixed price contract. Alternatively, the end user can take out the buy put after the fixed price purchase contract, using the benefits of a buy put to enhance price.

Analytical tools

Because weather influences yield that then affects production, prices, and forward markets, it may be argued that analyses of historical weather patterns of rainfall and temperature could be useful. Whilst more data may be helpful, change reduces the usefulness of the past for both current and forward decision making.⁵⁸

Predicting change based on historical movement of change can be fraught with danger. It is the improbability of forecasting variations and change for more than a week in advance that seriously reduces effectiveness of historical analyses.⁵⁹ If there was anything outstandingly predictive from any such analyses, there would be greater certainty but possibly no markets. It is uncertainty that drives buyers to buy and sellers to sell, with the volume of transactions more likely depending on the amount of uncertainty. Therefore the usefulness of analyses can be very challenging.

Factors such as inflation distort historical data, and it can be debated as to whose inflation should be used to deflate international prices into 'real'

prices.⁶⁰ Both inflation and deflation calculations require a base year, yet in commodity markets choosing any base year as an 'average' can be debatable and criticized as being 'abnormal'. Inflation-adjusted prices might be assumed to increase, yet commodity markets frequently deflate prices due to product surpluses. A buyer's costs and prices could be immensely different to the seller's price and costs simply due to inter-country inflation differences, currency movement relativities, and accountancy differences.⁶¹

Simple tools can often provide the most assistance to decision making. Adding the prices and dividing the total by a time period is a simple average but it can be an effective decision-making tool. A trigger for decision making could be whether price is above a long-term average for a farmer, or under for an end user. The problem lies in the selection of a time frame for the historical data.

One analytical tactic is to ensure that price analysis is performed in the currency of the major buyer. Much analysis is done in the domestic currency, yet buyers usually buy in a foreign currency. What the seller perceives in price analysis is not what the buyer perceives. One example is Australian wool being analyzed in Australian dollars, whereas much of the wool is sold to China in US dollars. The Chinese buyer does not analyze wool prices in Australian dollars, therefore sellers need a buyer perspective on price.

Analyses of single historical variables can be reduced to variation, with the most common being standard deviation which measures the variations from a mean average. Problems with standard deviation include the occurrence of statistical outliers, the subjective time frame selected, and no measurement of frequency of price movement. Attempting to forecast based on future projections of historical standard deviation is fraught with risk.⁶²

Skewness is a measure of frequency because it measures the number of occurrences over time. It therefore can measure the probability of achieving a particular price. The frequency and probability of price occurrence is the foundation of price curve distribution. Advantages of using frequency is that it provides a measure of probability of each price occurrence and it always includes statistical outliers, but it still has the problem of choosing a subjective time frame for appropriate measurement.

Cycles do exist for commodities,⁶³ particularly for agricultural products that are dependent on the cycles and phases of the sun, moon, and earthly gyrations for weather and solar events. It might be argued that human psychology is driven by emotional cycles that could be influenced by such external factors. Hindsight is far more insightful about cycles than their predictive capabilities.⁶⁴ If cycles were more predictive, then there probably would be more price certainty and therefore less market activity.⁶⁵ The corollary suggests that more uncertainty might lead to less predictability and therefore stronger markets.

The complexity and concurrency of many cycles obfuscates either any clear singular identification or any correct predictability into the future.⁶⁶ A combination of cycles is stronger than a single cycle and therefore can distort each single cycle. This reduces the capacity of any single cycle to regularly repeat itself as a forecasting tool.

Continuous spliced futures price data is mostly used for general commodity price analysis such as averaging, standard deviation, and skewness. Each spot month futures contract price is spliced onto previous spot month futures contract prices to establish continuous data, although there may be times when the second spot month might be used in a different data set. Back-adjusted 'real' price data according to some inflation-correction factor might only be useful for statisticians and in equity markets.

Charting analysis attempts to identify patterns of price movement such as trend continuation or reversal, with prediction based on recurrence of pattern outcomes. Bar charts, candlesticks, and point and figure charts are different methods used in charting analysis, as are support and resistance lines and the pitchfork method. Charting can be used on continuous price data or for particular futures contract month prices.

In contrast, technical analyses is more likely to examine movements of key market factors such as volume, open interest, relative positioning of opening and closing prices, daily highs and lows, trends following moving averages, action and reaction, and price momentum.⁶⁷ Technical analyses should only be used on prices for a particular futures contract month, and not used on continuous price data. It can be useful in establishing tactics for market entry and exit, and it may assist pricing and hedging decision making.⁶⁸

Technical analysts are more likely to use intraday movement such as open/high/low/close prices,⁶⁹ compared to the closing price analysis of statisticians. Whereas there is weakness in the subjective selection of time frames in continuous price data analysis, technical analysts avoid this criticism because their focus is only on prices for a particular futures contract month.

If prices are to change direction, the rate of price change in the original direction has to slow eventually to a stop, then there is uncertainty as price direction reverses, and then price has to increase the rate of change in the new direction. Trend identification through moving averages and crossing-over moving averages is merely following this trending process. This contrasts to price momentum which can actually measure the speed of price movement.

There are four measures of price momentum:⁷⁰ price rate of change (ROC), momentum, relative strength index (RSI), and stochastic oscillator. Different commodities and different price volatilities will suit some technical methods better than others. Price momentum may assist in identifying price gapping and slippage problems in market entry and exit, which can affect transaction costs.

9

POSTHARVEST ISSUES

Farmers expend an inordinate amount of time, investment, and resources prior to planting and during the production phase, but some readily want to waste it postharvest when the product finally eventuates. Hoping for a favourable production outcome preharvest is often replaced by price frustration at harvest time and then opportunistic behaviour postharvest in an attempt to improve price using the product.¹ The alternative is for a sale near harvest and the use of buy calls to enhance price after the sale, on the assumption of some price opportunities and market capability. Whilst an early sale plus buying calls does not capture any subsequent favourable basis movement, it does avoid subsequent unfavourable basis movement.

Dry-land farming is high risk and there can be frustration with low financial returns, especially when input costs are high. Postharvest retention could be 'efficient' if the risk: return ratio shifted towards low risk and high return.² However, if the preharvest high production risk: low financial return outcome was merely replaced in postharvest retention by high price risk: low financial return, then such action could be deemed 'inefficient' in risk: return decision making, particularly if product risk increased as well.

The greatest source of supply chain power for a farmer lies in the pre-harvest phase when decisions and product are denied to merchants and end users. Some product varieties and attributes generate far more buyer demand than others and this can create specific supply chain power prior to harvest. Farmers may even have some supply chain power at harvest through the eagerness of buyers to accumulate new product early. However,

supply chain power for many farmers diminishes after harvest as product supply increases and new crop quickly becomes old crop because of alternate hemisphere harvesting. Some farmers delude themselves postharvest when they attempt to rekindle the supply chain power that only existed preharvest.

Product rejection after an enormous production effort can cause seller anxiety that can spill over into anger, regret, fear of the consequences, personal deficiency, and revenge. Product might be rejected by buyers because of moisture content, product composition, test weight, defectiveness, or contamination, all of which may be factors beyond the control of farmers, but farmers retain the responsibility for the product until a sale has occurred.

Farmer perception of low price can drive opportunism, despite the historical price skewness and high probability of further price falls.³ Poverty trap desperation can spill over into group delusions that withholding sufficient old crop product can somehow equate to supply chain power when the product is only price-taking commodity.⁴ Speculation on price and currency movement through postharvest hoarding becomes not only respectable but often is mandated through cooperative effort.⁵ There is so much focus on postharvest old crop speculation that the price and currency risks attached to the new crop are mostly ignored.

Having produced a product with or without buyer interest, there is a tendency to perceive farm output as a capital asset despite it having wasting value through biological product attribute deterioration,⁶ increasing product risk to the supply chain, and financial risk through adverse downside price and upside currency movement. Even bank managers can fall into this false asset value trap. Retaining product ownership with a false perception of asset value is a common failing amongst farmers.⁷

Political intrigue and product storability are closely associated. There are few politics with perishable lamb and mutton, but storable wool has an extensive political history.⁸ The industry politics associated with storable sugar are immense compared to perishable cane.⁹ Whole political parties have arisen from the group dynamic intrigue of stored commodities.¹⁰

Historical granaries

Arbitrary storage of agricultural commodities has an almost archetypical position in history.¹¹ Armies have survived or fallen on the back of granary reserves.¹² Governments have based their taxation on storable commodities and quelled civil uprisings through cheap food supplied from granaries and salt reserves.¹³ The foundation of regulation is a stable food supply.

Both farmers and economists encourage the accumulation phase of government food stocks as if this was the panacea of all economic woes.¹⁴ They usually dismiss the increased procurement costs for end users in the government accumulation phase, and mostly ignore the devastation to both farmers and end users when the government dumps old crop stocks in front of new crop harvest, plummeting prices, and being bewildered why farmers are demanding subsidies and why end users are reluctant to buy poor quality product with low shelf life.¹⁵

Having created food reserve policies,¹⁶ governments have then been forced to deal with the problems of over-production,¹⁷ surplus stocks,¹⁸ and farmer poverty. There has arisen a search for optimal storage¹⁹ and carryover of old crop stocks,²⁰ as if this optimality could easily be identified given the dynamics of weather and consumer tastes. Serious debate is occurring over the relevance of food 'buffer' stocks to national security in an era of just-in-time delivery efficiencies, improved transport technology, and freer trade policies.

Storage categories

Stored agricultural product requires differentiating into commercial inventory and speculative storage. The first category includes all procured product and might include government catering, whereas the second category represents storage of unsold product by farmers, groups of farmers, opportunistic merchants, or governments as 'buffer' reserves.²¹ Storage can be proprietary, leased, or through toll warehousing such as up-country elevators, professional bulk handlers, or port terminal operators.²² The problem with toll storage is tracing legal ownership for unsold commingled product, particularly under bankruptcy proceedings.²³

Farmers can create time value in storing product for their own inputs, such as feed or seed, provided that there are adequate quality controls. The stored product has value to the farmer as an end user because of its product specification as well as the value associated with timeliness of input delivery. However, it may be difficult to distinguish on-farm end usage inventory from hoarded product storage, which can create confused value decision making.

Speculative storage by farmers can occur either individually through on-farm storage²⁴ or external storage, collectively through commingled pooling administered by cooperative or private management, or through a statutory authority whereby the farmer has no choice other than to deliver into a statutory commodity pool. Some farmers who are located near many

end users claim that storage is being used to 'opportunistically sell' to end users despite having no commercial trade agreement. Any opportunistic withholding of supply with no commercial trade agreement must be classified as hoarding.

Alternatively, a farmer may be able to form commercial trade agreements with merchants or end users by selling early and then profiting from on-farm toll storage, but only under strict quality control and logistical conditions.²⁵ The farmer receives storage rent but is usually made liable for storage insurance and quality assurance.

Government storage can be quite diverse. The largest single buyer in many countries is government, because public institutions such as defense, hospitals, prisons, and other utilities need food and clothing to dispense, at the same time that public tenderers procure product for the private sector. A government auditing dilemma occurs when separating what is immediately required as product inventory in public catering usage from that which is purchased as a speculative buffer to meet some vague government monetary or political objective.²⁶ If all public catering purchases are based on just-in-time delivery, then there is no problem in differentiating government speculative storage.

Reasons for delayed selling

The ideal supply chain might have all production in perfect product alignment with the end user, a price that is mutually satisfactory to the producer and end user, cash flow with suppliers and contractors paid on time, systematic ownership transfer, and forward transactions that would facilitate financing and investment, with final consumers being satisfied most of the time. The problem is achieving such idealistic supply chains with sustained profitability.²⁷

Proponents of grain hoarding and pooling have argued that storage improves product quality, which is then used as a justification for supply withholding and price speculation. However, any product improvement is product specific and only under certain circumstances, which undermines any justification for general hoarding and speculation. It can be argued that product quality maintenance should be the responsibility of technical specialists within merchant operations who can facilitate laboratory testing according to end user specification, and therefore should not be the responsibility of private hoarders, commodity pool managers, and general warehousemen.

Milling wheat reaches a maximum of maturation within two to four months of harvest, based on an increase in protein stability, slight decrease

in enzyme activity, and an improvement in bread-making quality.²⁸ However, this only applies for sound grain at intake under ideal conditions of grain moisture, temperature, and humidity.²⁹ Agronomic factors such as the sulphur: nitrogen ratio,³⁰ and stress-related factors due to marginal growing conditions and adverse weather can cause early deterioration of milling wheat by decreasing rheological and baking properties. As storage time is extended even for sound kernel wheat, flour performance becomes inconsistent, there is a decrease in subsequent water absorption and loss in loaf quality, and an increase in mixing requirements and ingredient costs.³¹ These are product risks associated with stored wheat, which can then contribute to increased supply chain risk.

Whilst malting barley has entirely different product quality attributes to wheat because malt extraction is based on grain germination, it is similar in that grain maturation through enzyme activity reaches a peak during storage before germination vigour declines. Some late-maturing barley varieties may require up to nine months storage before reaching maturation, which suggests varietal specificity.³² Agronomic, adverse weather, and marginal growing conditions also affect kernel soundness and cause wide time variation to malting barley quality deterioration during storage.³³ It can be argued that both product and supply chain risks are high if product ownership remains with those whose sole focus is on price speculation with no laboratory testing.

Harvest time for a biological product can be the weakest link in the food handling, transport, and logistics supply chain.³⁴ There can be the usual chaos during receivals that may be weather dependent, compounded by labour union laws limiting receival operating hours, unloading delays caused through biological testing for different quality segregations, and sometimes inadequate infrastructure especially when there is no flexible bunkering. Logistics costs at harvest time can erode the ex-farm gate price.³⁵ The irony is that some farmers want cooperative or statutory monopolies despite the associated centralized logistic congestion and intake inefficiencies.³⁶

Price can often be the sole reason for deferring a sale after harvest.³⁷ Some farmers argue that price in postharvest decision making is the key to preharvest profitability, despite a commingled undifferentiated deteriorating quality old crop product that might only find a buyer of last resort at a heavily discounted price due to increased supply chain risk.³⁸ More astute decision makers might take price out of postharvest decision making, thus allowing cash flow, product alignment, quality, and relationship marketing to dominate decision deliberations, in which case they are more likely to

be price makers with highly differentiated product. Farmer politics is often divided between these two groups of farmers.³⁹

Farmers who take price out of the supply chain relationship and are prepared to manage price quite separately are usually fiercely independent and want freer trade. These farmers may have been more focused on price risk management during the production cycle, with cash flow at harvest satisfying the needs of bankers, creditors, and farm input suppliers to enable further production viability. It is highly probable that these farmers may be in a better position to focus on new crop development.

This contrasts with the other group of farmers who forego early pricing opportunities and want postharvest solutions to solve profitability problems after normal supply chain buyers have departed.⁴⁰ They are prepared to forego cash flow at harvest, thus jeopardizing the repayment to bankers, creditors, and farm-input suppliers, which then threatens further production viability. These farmers are very distracted from important decision making regarding new crop development.

Disadvantages of delayed selling

There is nothing simple about delaying a product sale, which may explain why some farmers become obsessed with old crop retention to the detriment of new crop development and cash flow viability. Retaining ownership of something that was very difficult to produce may have roots in archetypal psychology.

Holbrook Working surmised that much storage would be hedged,⁴¹ whereas many farmers perceive hedging as defeating the speculative motive for storage.⁴² Price enhancement is often the sole objective for postharvest storage for those farmers who store despite the risks incurred and despite the existence of alternative price enhancement strategies.⁴³

Preharvest is usually dominated by buyers willing to buy, with price being established by the strongest buyer. In contrast, postharvest is generally characterized by sellers wanting to sell and price being determined by the weakest seller. It is not coincidental that unsold postharvest storage is closely associated with price-taking commodity.

Delivering unsold product into external storages or a commodity pool is akin to selling on consignment, which has long been recognized as the worst possible selling method for farmers because of its risk-taking speculative selling and pricing outcomes.⁴⁴ The transfer of responsibility for selling and pricing to a pool manager or warehouser could be perceived as an act of desperation or a vain hope for a favourable price outcome.⁴⁵

Often there is denial that delaying a sale postharvest is speculative. Unsold commodity involves speculation on price, currency, and basis, irrespective of where it is stored.⁴⁶ It is a price-taking situation because of withholding and possible exclusion from commercial trade markets, with no carry-contango rewards for storage. The ultimate selling price will reflect the prevailing local spot price as well as any price discounts from storing old crop product external to commercial trade markets.

Price speculation may be the main driver for postharvest storage, but it is the price discounts and adverse basis that will ultimately determine storage profitability.⁴⁷ Local spot price less any price discount must rise more than the storage cost plus opportunity costs of money for a storage strategy to be profitable, assuming no product deterioration and that storage costs include product shrinkage. Alternatively, the realized financial returns need to justify the added high risk-taking because of frequent financial and product losses.

The skewness of agricultural prices seriously reduces the probability of favorable storage outcomes to occasional occurrences for most storable products. It is worsened by the lack of sufficient price volatility that would facilitate the occasional selling into higher prices to make storage profitable. The high propensity for low prices and the lack of price volatility can explain the desperation in postharvest politics, which can spill over into demands for subsidies and government intervention.

Industry politics invariably commence once a decision has been made to defer a product sale. The absence of politics for perishable lettuce can be contrasted to the dominance of politics when new crop wheat becomes old crop storage. Many agonizing farming frustrations can be unleashed before the old crop is finally sold.

Delaying product selling foregoes spot market cash flow benefits, thus incurring major opportunity costs of money which can include interest on debt, interest foregone on potential investments, and the loss of goodwill amongst input merchandisers and contractors which can jeopardize new crop prospects. Harvest contractors who have not been paid for 12 months are unlikely to be overly eager to harvest the new crop, and the merchandiser is unlikely to extend credit on fertilizer and fuel.

The real cost of private storage is rarely calculated accurately, particularly the extra handling and labour charges, the opportunity costs of money, speculative financial losses, product spoilage, and perhaps the extra distance and freight when the commodity is finally sold or rerouted due to intake policy restrictions.⁴⁸ It is difficult to apportion costs for farmer deaths and injuries incurred through wind gusts on bunker tarpaulins, silo suffocation, or through fumigant poisoning.

Quality control in agricultural product storage has an inherent risk element involving inadequacy, increasing biological resistance, and product contamination including mycotoxins and spoilage.⁴⁹ Much depends on intake policies, moisture, temperature, and humidity, as well as stack management procedures.⁵⁰ Rodents, birds, insects, and diseases such as fungal spores can all be problems, and can increase the risk of heat, fire, and explosion.⁵¹ Quality control is a major problem for professionals attempting to meet supply chain specifications, which suggests that some farmer attempts can be quite amateurish and outright dangerous.⁵²

Costs can be very high regarding the drying of product to reduce moisture,⁵³ mechanical aeration to reduce heat and humidity, chemical fumigation to control insects, protection against birds and rodents, and managing general spoilage.⁵⁴ Perceived or unknown product longevity can be influenced by inconsistencies inside the stack.⁵⁵ Sealed storage may reduce some costs, but this requires higher initial investment and working capital costs.⁵⁶ Physical raw sugar losses during private bunkering in India have been reported to be as high as 20 percent.

Agricultural products are biological with a moisture component that is prone to loss over time. Non-fibrous products can shrink with weight losses that can impact on product quality.⁵⁷ Shrinkage may represent a minimum real loss of 0.1 percent per month to the product quantity in private storage, but this depends on the product and can increase under some storage circumstances. Farmers bear the losses due to product shrinkage and milling quality damage whenever delayed selling occurs. In contrast, shrinkage losses for fibre products such as cotton and wool might be very minimal.

Different products and varieties require different storage standards and costs. Malting barley would require more exacting storage control standards than feed barley storage.⁵⁸ The risk of downgrading from food to animal feed is high whenever selling is delayed, and must be considered as a potential cost through price discounting. Opportunistic product blending in an attempt to reverse the downgrading usually results in failure due to product attribute inconsistency, the loss of goodwill, and destruction of quality image. Successful blending might result only under specific end user guidelines.

Financial losses due to falling prices and rising currency rates must be considered a storage cost. Much deferred selling occurs in an increasing carry market when the forward market is signaling increasing old crop surpluses. To speculatively store old crop in the hope of prices rising when the forward market is signaling prices falling is dysfunctional decision making, particularly when combined with storage risks, costs, and new crop

distraction. Strategic basis trading⁵⁹ and contrarian tactics⁶⁰ should be confined to speculative merchants who wish to focus on small financial returns and high risk that includes the potential for bankruptcy.

Product value can depend on harvested quality and subsequent storage conditions.⁶¹ The problem is determining the turning point when value creation finishes and value destruction begins, particularly when this value-neutral point varies with variety, initial quality, and storage management. Farmers do not have the capability to determine value-turning points.

Characteristics of hoarding

The psychology of the individual hoarder is different to the farmer wanting group activity and commingled product pooling. To forego cash flow and debt repayments in exchange for hope can require determination that is often driven by farm poverty desperation or extreme opportunistic behaviour.⁶² Whilst anxiety may not be a common trait of a hoarder, there may be much regret and avoidance over past experiences with alternate pricing and selling strategies.⁶³ Hoarding does tend to increase with supply chain dysfunction, as evidenced by recent Indian government price controls and intervention.

Farmers can react to product rejection in the supply chain by hoarding rather than accept price discounts. The problem is that discounts are likely to increase with hoarding rather than decrease. Acute product shortages can make hoarding profitable, but such occurrences may be infrequent.

Many hoarders tend to be focused on local price movement relative to an international price benchmark. Whilst farmers may hoard as basis traders, it can be argued that any trading of basis should be the role of merchants because they are more likely to have hedged futures price and currency. Hoarders hope that basis reverts from being negative with local prices below an external benchmark price to positive with local prices above an external benchmark price, sometime before the next harvest.

On the assumption that the farmer hoards a product that has some early relevance to an end user, there can be mutual antagonism because the farmer has chosen to combine product retention with price speculation. The buyer wants the product and the farmer wants a higher price. This can be further justification for separating the product from the pricing by having an early product sale and using buy calls to then enhance price if prices rise. However, this entails foregoing basis trading.

Some hoarders may sell good quality product and hoard low quality product, whilst others sell the low quality product and retain the better one.

Early cash flow thus finances the subsequent hoarding. Much depends on the product attributes, their relevance to the supply chain, forward market carry and backwardation conditions, and new crop expectations.

Individual farmer hoarding may occur wherever there are many local buyers and end users, whereas they may group into commodity pools in regions with few local buyers and end users.⁶⁴ An individual grain producer is more likely to store feed grain in an area of many dairy farmers. Therefore, locality and the clustering of domestic end users may influence how farmers speculate postharvest.

Farmers may not have any comparative or competitive advantages in producing a product variety in a certain location as reflected in continual buyer rejection, yet persist because of the hope of periodic product shortages spilling over into higher commodity prices. The presence or absence of local end users and cluster industries should guide farmers in what they produce, yet this seldom occurs. Rejection by international buyers based on region or port because of previous poor product buying experiences can devastate farmers, but no amount of hoarding will change the outcome except under extreme product shortage conditions. Geographic location, varietal characteristics, and agronomic conditions are important in any postharvest decision making.

Farming practices that produce unwanted product are highly questionable, but this is worsened by a farmer rejecting some buyer interest at harvest time only to incur many subsequent product problems and supply chain disadvantages postharvest. Some farmers want tax-payer subsidies and government intervention rather than confront the reality that their farm output could be largely unwanted.

If farmers are not part of commercial trade markets, no time value is created postharvest. Buyers are highly unlikely to pay a farmer to store unsold product that is outside a commercial trade agreement. Therefore there is no carry reimbursement or commercial reward for storing hoarded product. This makes it highly questionable why farmers should be delaying sales and speculating on price after harvest.

Having committed to one type of storage after harvest, farmers can be subsequently denied access to alternate storage types and facilities. This may be due to predetermined intake time restrictions for quality control implementation, or cross-storage quarantine to minimize contamination or infestation. Failure to meet such delivery times and product protocols can result in product rejection from supply chains.

One of the supposed advantages of hoarding is that it defers selling of commodity to a more opportune time, when spot market prices are hoped

to be much higher than when storage commenced.⁶⁵ Price is expected to increase without any commercial trade agreement and without any guarantees on supply chain value.

It is often assumed that when harvest prices are low because of many crop receivals, local prices will rise when deliveries dwindle. The reality is that local prices could fall further because of adverse domestic currency movement, increased international new crop production, higher freight rates, or alternatively sourced supply that could worsen basis.

Diversified farmers who have a range of alternate sources of farm income may be more likely to hoard because there is less income dependency.⁶⁶ In contrast, those farmers who are very specialized in single farm enterprises have a much lower propensity to hoard. To err in hoarding when farm income dependency is high is to jeopardize financial viability.

Farmers with a recent history of incurring financial hardship through drought or infrequent rainfall may hoard in an attempt to recoup financial losses, in contrast to farmers who have more regular sustainable income.⁶⁷ Whereas high cost farmers such as irrigated cotton growers with relatively low production risk might be more willing to manage their price and currency risk,⁶⁸ high debt farmers with high production risk may be more likely to hoard.⁶⁹ Consistent risk taking seems to be a characteristic in the hoarder psyche.

Retaining product ownership through on-farm storage usually requires finance, assets, human resources and management. These added responsibilities usually arise at a time of seasonally high debt and low cash flow. Good management might suggest that speculative storage be limited to income which can be afforded to be lost. Tax-payers in the USA finance on-farm speculative storage by providing appropriately timed cash flow subsidies to farmers.

Hoarders may perceive themselves as conservative despite their high risk taking, although they are likely to change their risk profile depending on their role in the family, farm, and business.⁷⁰ Their perception of asset value holding can mask the real risk of failure. The irony is that those farmers who sell at harvest time may be more likely to perceive themselves as risk takers.

Delaying a product sale introduces the dynamics of change regarding product, supply chains, buyers, consumers, freight, price, and currency exchange. What was originally intended can become subsumed by changes in internal and external circumstances, psychology, and peer group pressures. Hoarding invariably requires the farmer to manage this change. They can retreat in stubbornness into isolation, but this may merely reflect their relative position regarding commercial supply chains.

Hoarders may have a tendency to make decisions alone, usually without any involvement of partners, spouses, or external advisers.⁷¹ They can ignore any advice from their accountants and bank managers regarding cash flow, debt repayment, and opportunity costs. There may be spontaneity in making decisions which results in them being unlikely to deliberate over decisions or use planning in decision making, unlikely to examine strengths and weaknesses of alternate strategies, and unlikely to collect information or analyze data.

Those farmers who hoard may be reluctant and skeptical in the adoption of new selling and pricing ideas, and unlikely to be traditionally venture-some, with few undertaking new innovative risks or following others in innovation successes.⁷² Making pricing mistakes during hoarding may not provide any motivation to do anything differently next time, thus tending to absorb the financial losses and repeating the same decisions on the rationale that probability will eventually provide profitability.

However, hoarders may be among the few farmers who are likely to perceive that they achieve 'realistic' target prices.⁷³ Many merchants argue that the target price of hoarders continually shifts depending on price movement. If prices do rise, the target price of hoarders is usually increased, but still with the reluctance to sell because prices might be higher tomorrow. Larger merchants tend to leave hoarder purchases to the smaller regional merchants who have greater knowledge of the individual farmer psychology.

High forward prices relative to the spot price are frequently mistaken as indications of future shortages by many farmers in general, but hoarders in particular, when in fact the market is signaling carry surpluses and a bearish market. This misinterpretation can encourage hoarders to store in surplus markets, which probably will cause prices to fall further. Even when spot prices are high, the hoarder may not sell in the hope of even higher prices, and then misses the opportunity when prices fall quickly.

Any potential goodwill in the extended supply chain is quickly dissipated with hoarding. The lack of cash flow may result in contractors and merchandisers not being paid for lengthy periods of time, which can jeopardize future farm operations. Farm income losses due to the lack of necessary contractors or merchandise, or the incurrence of higher loan interest rates, need to be factored into hoarding costs.

Characteristics of pooling

Traditionally, a farmer-based commodity pool was defined as unsold commingling of product by a group of farmers. Some perishable products such as sugar cane and fresh milk had to be pooled because of the manufacturing

process and quality control. In contrast, pooling of storable products was usually undertaken with the specific aim of delaying sales to enhance price after delivery through price speculation, which generally ended by merely averaging sale prices over the pool duration.

Privatization and deregulation combined with new logistical innovations in bunkering techniques have meant that defining a commodity pool has become less precise. There may be segregated product, and merchants can be involved with pool organization. Volume-driven merchants can directly organize their own pools to accumulate product, or they can indirectly contract with farmer-based co-operatives who accumulate product through pooling.

The general characteristic of all commodity pools is the transfer of selling and pricing decision making responsibility from farmers to pool managers, regardless of whether they are private operators, cooperatives, statutory authorities, or merchants. Irrespective of the type of management, pools are also characterized by a lack of transparency in costs and prices, with no disclosure of market position. Pooling contrasts with an individual private seller who knows the exact transacted price and cost, where the title transfer occurred, and who has market exposure risk.

Any generalizing as to actually where ownership title transfer occurs has become difficult, but this should depend on the terms and conditions of the pool agreement. Determining exactly where title transfer occurs is extremely important because it should indicate who has the market position and price risk. Similar to the sugar cane example in Chapter 4, it could be that product title has been transferred to a mill or merchant, yet the farmers still bear all the price risk and currency exposure for the duration of the commodity pool until finalization occurs.

Title transfer can also determine cost responsibility, which is rarely disclosed in pool audits. Pricing origin port or destination port can determine just how far the farmer under pooling is made responsible for costs in the supply chain. The farmer could bear all the logistics and freight costs, particularly under cooperative management or statutory authority, and especially when price-taking commodity sales are priced in-store into the buyer's warehouse. Cost and supply chain risk is much higher for commodity pools that are based on international sales compared to those based solely on domestic sales.

Pool operational efficiency is never publicly transparent, particularly when there are monopoly pools with no benchmarks for performance. Management fees may be intermingled with logistics costs, which generally reflect the pooled collective mentality and difficulty in performance

auditing. Some farmers have claimed that pooling reflects all the dangers of agrarian communism.

Regardless of whether a merchant directly or indirectly operates the pool, or whether they transact with pool management during a selling phase of the pool, there is nondisclosure of the transacted price and quantity. The merchant might be able to access the pooled product and sell portions of it during the duration of the pool, with the pool price only being determined at pool finalization based on a formula using net proceeds, as occurs with some sugar mills.

A merchant or mill operated pool is extremely unlikely to disclose internal transfer prices. The merchant may have discounted the purchase price from the pool because of commingling and supply chain product risk. There can be very legitimate supply chain reasons for price discounting, but these should be disclosed as part of the performance audit of the pool. Many merchant-controlled pools are operated conjointly with other business operations in seamless product and logistics flow, with no segregation of pool costs and sale prices, but somehow deriving net pool proceeds from account aggregation.

Price averaging through pooling when commodity prices are skewed against sellers results in low prices for much of the time, even without the cost of money considerations involved with the loss of cash flow. Averaging sale prices over a time period with a positively skewed price frequency cannot provide sufficient justification for using a commodity pool. Also, extending pooled product into the new crop year can undermine the new crop price because of the price discounts associated with the old crop.

Without commercial trade merchant involvement, pooling can be perceived as merely spreading sales over time when there is a high propensity for low prices. Staggered selling of uncertain product under positive price skewness will not shift the price curve to a more 'normal' price distribution. Attempts may be made to disguise the pool speculation as 'organized marketing', however the product generally remains unpriced, speculative, with high product and supply chain risk.

Delivery of unsold product into a commodity pool must be considered selling on consignment despite its collective characteristic. Unless commercial trade merchants are involved with the operations, the pooled product cannot be categorized as part of the supply chain because it involves unsold product being withheld from commercial trade markets.

Despite the incongruity as a commodity price taker, pool managers are generally expected to maximize price. Any management efforts to protect downside price exposure can be derided by farmers as undermining the

profit maximization objective of most commodity pools. Hedging transaction costs are frequently perceived as opportunity costs of potential windfall foregone.

Commodity pooling might be more prevalent in more marginal production regions where end user activity is minimal because of high delivery risk. However, it can be debated as to whether commingled commoditization can further alienate end users, especially when a monopoly pool exists. Many end users cannot utilize non-segregated product. However, some flour millers who need supply continuity argue that monopoly grain pooling can provide specific product availability because of regional stack selectivity, whereas private hoarding limits such local supplies during shortages.

It might be claimed that grain pooling is unique in that regional silo stack segregation occurs despite the egalitarianism of commoditization. Silo stack segregation creates product selectivity that may favour some end users, however, the pool price equalization is a disincentive for those farmers who produce a product that has relevance to the supply chain, and rewards those farmers who produce a product that has little relevance to the supply chain.⁷⁴ Farmers who are high quality achievers can be hugely disadvantaged by the commingling of low quality in commodity pools.

If farmers group into commodity pools in those geographical regions with few local buyers and prolonged low prices, this may be a clear supply chain signal to farmers to shift their farming practices to localities where merchant and end user activity is higher. Merely pooling product in a speculative attempt to achieve higher prices may defer price retribution to a later date, usually after inflation has increased input costs relative to output prices. Government production promotion or income subsidization in such marginal regions does little to secure the supply chain or sustain the long term viability of the farmers.

Whilst it could be argued that end users are largely absent because of the problems of commingled pooled product, end users are unlikely to invest in those regions with uncertain supply. Possible solutions include finding alternate farming enterprises that are better suitable for marginal regions, facilitating farmer mobility between localities, and allowing farm amalgamations to increase land sizes. Farmers need to synergize with those enterprises and supply chains that have high merchant activity, commercial trade markets, and cluster industries.

In an era of increasing food biosecurity, commingling of commoditized product can prevent segregation, identity preservation, product traceability to its origin, and differentiated quality controls.⁷⁵ Ironically, there can be information asymmetry of aggregate pool data disclosure towards

data-obsessed farmers who do not use the product and to international competitive merchants, but such information may be quite useless to those end users who actually use the product.⁷⁶

There is a huge divide between farmers and associated bulk handlers who want uniformity and economies of scale cost reduction, and a commercial trade market that needs specific product segregation and individualized quality management that necessitates higher cost. The bulk handler dilemma is that cost reductions and logistics efficiency through product commingling often reduces product usefulness in the supply chain.

Grain commodity pool aggregation can often represent indiscriminate blending into a commingled potpourri that can frequently remove any relevancy with end-user supply chains that are driven by manufacturing technology and consumer needs. Averaging to meet grade standards through blending becomes meaningless to an end user requiring product consistency. Grading categories are often more aligned to product intake policies for pool administrators, and not for meeting particular product specifications for individual end users.⁷⁷ If a merchant purchased product direct from a farmer, product grading is replaced by sample testing to meet particular end user specification.

Farmers may decide to deliver into a commodity pool only what cannot be sold elsewhere, which makes the pool a second-best last resort strategy. This may result in time delays for farmer decisions regarding pool deliveries, with little control by pool managers over quantity, quality, or timing of pool intake. This makes selling more difficult for pool management. It tends to drag the pool down to the lowest common denominator with largely unwanted commodity that necessitates an even longer period to sell unless there are large price discounts.

Some farmers deliberately pool low quality product in an attempt to average up their quality against better quality deliveries from other farmers. An averaged quality product mix favours those farmers with poor quality because they get a higher pool price than they would otherwise have achieved with individual selling.⁷⁸ Farmers who deliver low quality product into commodity pools are the real freeriders.

Performance-driven food and fibre supply chain management necessitates field inspections by merchants or end users, product sample testing, and early quality controlled product segregations. If farmers choose to deliver unsold product into a commodity pool in lieu of field inspection, then they must accept the resulting supply chain risk and its impact on price.

If product rejection either before or at harvest seriously impacts on farmer morale,⁷⁹ merely pooling product in response is likely to worsen the

position of the farmer in the supply chain. Grouping together and pooling rejected product may worsen product acceptance and expose farmers to increased product risk and supply chain risk. Pooling will not make an unsuitable plant variety or grade more appealing to an end user.⁸⁰

There is a delusion by some farmers that somehow forcing end users to buy unwanted product from a commodity pool somehow equates to supply chain power. Pool sellers may command some power over price but only during infrequent acute product shortages and only if there are no product substitutes or imports.

Actual power for farmers may occur when they pressure governments for statutory solutions or lobby for import bans, despite domestic end users having an inability to use pooled product. If there is a lack of consistently supplied specified domestic product or if imports are prevented, then domestic end users have no alternative other than to close down or shift operations offshore. Whenever commercial trade markets cease operations, there is then no functional role for domestic merchants. Pool managers then are forced to become dependent on exports and international merchants.⁸¹

Merchant activity will be strongest wherever there is product that meets end user demand and specification. In contrast, any pooling of product that does not meet end-user needs is unlikely to generate merchant and end user interest either in demand or local investment. Merely commoditizing their product can shift farmers further away from the supply chain and increasingly alienate them from end users. Some farmers may be gratified by the ultimate demise of merchants, but it is domestic merchant activity that is the barometer of supply chain relevance and success.

Sellers often sell to the perceived strongest buyer because of the higher probability of being paid. Buyers often favour the strongest seller, or select lower risk farming districts, because of the lower probability that delivery default will occur. Paradoxically, price generally rises under intense merchant competition, and falls when merchants are disinterested. To blame the merchant is to ignore the messenger with supply chain signals.

Some voluntary pools only operate once minimum quantities are reached, which creates uncertainty of operations for farmers and pool management, as well as potential buyers. Uncertain supply can be very expensive for pool managers who have to ensure minimum capital repayments to banks and fulfill export ship contracts under tight loading schedules.

One difference between individual hoarding and pooling is the time extension, with grain, pulse, and sugar commodity pools often being extended for 18 months and well within the boundaries of new crop sales. Oilseed pooling can be limited by the rancidity of lipids. In contrast,

individual hoarding is likely to cease well before new crop commencement because of the awareness of price discounts associated with warehouse maintenance schedules. Individual hoarders with segregated product might respond quickly to price signals whereas pool managers might be forced to wait for buyers of last resort because of uncertain commingled product.

Any delay in selling postharvest through pooling can result in the farmer incurring all stored product risks, shrinkage, supply chain risks, costs, and sometimes even freight to the destination port. If the product was sold to a merchant or end user at harvest, then all such costs and risks would be transferred to the buyer.⁸² Commodity pooling can therefore subtly retain farmer ownership and responsibility, which may suit those volume buyers who seek last-resort sales with minimum supply chain cost and investment. The irony is that final pool prices may not be all that different to the harvest cash price, yet the pooled farmer has had to incur all storage charges, product shrinkage and deterioration over time, supply chain logistics costs, pool management fees, asset levies, as well as their own opportunity costs of money.

Most pool administrative and operating costs are an additional cost burden to farmers who use the pool. When farmers deliver into a pool, they are selecting a selling method that usually receives no compensation or reward from end users in commercial trade markets. Commodity pooling does not attract any contango for deferred delivery or carry for storage because it is uncertain high risk product that is withheld and isolated from commercial trade markets. As such, commodity pooling is the dream of economists and the nightmare of supply chain end users.

If pooling extends farmer ownership and responsibility vertically into the supply chain, this removes any need for international merchants to invest in the exporting country, particularly when capital investment involves high financial risk because of uncertain production and supply. Neither domestic merchants nor end users are likely to invest in much supply chain infrastructure when there is a lack of ownership of an uncertain product. However, farmers, pool management, or governments are also unlikely to provide adequate or timely investment in supply chains.⁸³ Therefore domestic food and fibre supply chains can languish and become inefficient.⁸⁴

Commodity pools generally require storage, handling, and port terminal assets that are usually funded by farmer levies through mandatory pool fund deductions, because there is no voluntarily reimbursement by end users for unsold product storage. If the commodity pool results in a domestic monopoly, then some storage costs may be forced onto end users through monopolistic price control, assuming no product substitution.

A problem lies with farmers being compulsorily forced to pay for commodity pool assets through mandatory levies or pool deductions, with farmers retaining no equity ownership in such assets. This allows pool management to sell off storage, handling, and port terminal assets that were funded by pool users, with no financial return or equity compensation to farmers. Pool managers can operate with little profitability through the pools on the understanding that they will have a windfall gain when pool assets are finally sold. If cooperatives own the assets, then farmer members can be denied asset value whenever they transfer or sell their one-dollar shares. Economists then ponder why farmers exist in a commodity poverty trap!

If commodity pools are linked to professional bulk handlers, there may be excellent quality control during storage of pooled product.⁸⁵ However, this cannot extend product life after optimal maturation has occurred, nor can it eliminate protein oxidization, starch deterioration, enzyme activity, disulphide cross-linkages, falling numbers, bucky wheat, lower kernel weight, or lipid rancidity.⁸⁶ There may be little or no value in a supply chain for a product whose quality specification is not controlled and managed from an end-user perspective from the outset.

Despite frequent farmer rhetoric that pooling prevents speculator exploitation and that the pools can judiciously feed the supply chain, most pool managers rely on price speculation and suffer from a lack of international skills, network experience, and effective resources.⁸⁷ Managers may not be supported by board directors of the pool organization, particularly if they are mostly farmers seeking maximum profit through price speculation.⁸⁸ Quite often commodity agents and brokers are appointed to fill voids in pool management experience and capability, but this often leads to cost increases, dilution of control, and audit difficulties.⁸⁹

The perceived benefits of pooling have often been purported to lie in economies of scale, whereby unit cost decreased as quantity increased. However, few economies of scale benefits are attainable when both the quantity and quality delivered into a voluntary pool vary greatly. Product segregation is perceived to be wasteful in terms of time, costs, and resources, despite the buyer discounts that are associated with commingled product. Supply chain problems increase whenever private commercial inventories are not clearly separated from unsold commodity pooled stock within the one bulk handling operation.

There often is an erroneous group perception that efficiency increases proportionate to size. The larger the pool, the more likely there will be congestion in delivery queues and delays in sample testing, unloading, and elevation, which will add to both farmer and pool costs. From an out-turn

perspective, many international end users want just-in-time deliveries and do not have the logistics capacity to handle irregular, supposedly more efficient, large bulk shipments that then require large early cash flow payouts, subsequent storage, and product risk.⁹⁰

Lofty economic ideals over cost savings can lead to frequent unrealistic expectations over capability, assurances, and final estimated pool prices and financial returns, which can attract farmers to sell into a commodity pool.⁹¹ However, collective price gains are illusory if they merely shift costs back to the farmer through pool deductions.⁹² It is common for structural impediments, operations bureaucracy, and management lethargy to restrict organizational efficiency and increase costs. Competition amongst private pools might lead to some efficiency gains, however the top pool performers in one year are unlikely to be the same in the following year because of changes in markets, supply chains, and perhaps management.

Large commodity pools are generally indicative of surplus bearish conditions. Whereas private hoarders might respond quickly to falling price signals, groups tend to assume some immunity from price falls under the guise of price spreading. There is a real danger that price spreading results in merely averaging down lower prices in a scaling effect. Whereas a pool strategy may only achieve its highest performance ranking amongst alternate selling and pricing strategies when averaging off price peaks, pooling at low prices can realize the lowest ranking.⁹³ Historical pool performances immediately after price peaks are no measure of future pool success.

The removal of intense selling competition amongst farmers in the spot market at harvest time may be an advantage for pooling. Local prices might rebound quickly once harvesting pressure is removed. However, any price gains postharvest would be equally available to private hoarders, and perhaps even for those with buy call options. The real danger is that global surpluses keep increasing and prices fall during the life of the pool.

Any deferment of sales through pooling affects the supply chain through the spot market, basis, and the withholding of forward supplies from commercial trade markets, as well as maybe causing disruptions to the freight market. Unsold product storage on a large scale unnecessarily complicates forward markets that are dependent on commercial inventory signals in an efficient warehouse market based on carry. Without such efficiency, a liquid forward futures market is either unlikely or would be dominated by speculators and not balanced with hedgers. Even worse, without a liquid futures market that can lead to a liquid options market, there is no alternative postharvest strategy available to a farmer when prices are low other than to withhold supply.

Commodity pools are notoriously difficult to financially audit and to have cost transparency.⁹⁴ Monopoly pools have no benchmark performance criteria and little commitment to cost disclosure even under legislative pressure. Private pools and even cooperatives may have little incentive to dissect and disclose specific pool costs because it reflects on their operational performance. There is no consistency in measuring efficiency based on annual pool comparison because of different product, intake time variations, price and currency exchange differences, and supply chain changes.

Noncommercial commodity price premiums cannot exist because of the price-taking characteristic, except when there is corruption occurring or where foreign policy trade-offs exist. The Iraqi food-for-oil scandal was one example of corruption leading to artificial higher commodity prices and then to money laundering.⁹⁵ If international buyers paid a higher price in a commodity supply chain, they would soon be bankrupted by competitive pricing. Any so-called price premium accruing to commodity pools is more likely to be merely due to shipping freight rate advantages over competitors.

Pool users are unlikely to recognize that separating physical selling and pricing is important.⁹⁶ They prefer to combine the two decisions in a commodity pool and transfer the responsibility of selling and pricing to a pool manager, despite the availability of private discretionary management services that manage selling and pricing quite separately.

Pool administrators are usually judged by pool users on their price performance and their ability to fund the pool with early farmer payouts. Pool users want price speculation as well as cash flow, and any delay in sizable farmer payments is a cause for grievance. However, there is a trade-off between deferring pool sales in an attempt to achieve higher prices and higher pool funding costs, particularly when interest rates are high.

Product ownership and title transfer under different types of pool organization become very important for insurance, financing, and legal proceedings such as bankruptcy and liability. Ownership of pooled or warehoused product is usually presumed to reside with the original depositor, however, a problem arises with commingling in that individual identity cannot be established. English law has been historically consistent in that the depositor must be able to clearly identify each individual product for ownership to be established, otherwise ownership reverts to the holder in legal proceedings unless otherwise stated or legislated.

It is the function of merchants in commercial trade markets to finance the accumulation of product because they own the product and usually have forward sales. Banks are therefore more likely to finance merchants,

and less likely to finance pool managers who have dubious product ownership and no forward sales. This makes it very difficult for pool managers to arrange presale payments to farmers. Tax-payers are now more unwilling to act as financial guarantors for speculative pool funding than they were under government regulation during the twentieth century.

As last-resort high cost finance, pool operators can obtain presale finance through Total Return Swaps with banks, which requires the pool manager to sell the pooled commodity to the bank in return for cash flow provisions for farmers, and then buy the commodity back later from the bank when a physical sale is made possible through the pool. However, the purchase and selling prices are determined by the bank, which results in costs being much higher than normal bank lending interest rates. Also, the bank usually requires the hedging of price, which is generally incongruous with the commodity pool objective. Even the legality of ownership transfer to the bank might be questionable given the commingled product, unless specifically stated in the pool terms and conditions with farmers. Regardless of product ownership concerns, the pool user bears the high cost of such presale finance.

The delayed selling and payment characteristics of commodity pools can both increase and extend private farm debt, which must be considered as an added cost of pooling. This explains why some farmers delivering into pools want an early payout. The financing cost associated with an early payout may be reflected in a pool price discount to the farmer.

There can be a big difference between the psychology of private hoarders and group poolers despite the similarity in deferring postharvest sales.⁹⁷ Private hoarders may be loners because of indifference that sometimes might be explained by farm income diversity, the proportion of product hoarded compared to total farm output, or farm subsidies. In contrast, those farmers who mainly use commodity pools are likely to be more specialized with higher product dependency regarding farm income and no farm subsidies. They tend to be more emotional, with obsession over product retention, and may fear product rejection and its consequences on farm income.

Poolers tend to include farmers who like group discussion and socializing, which might be a consequence of rural isolation. The essence of the group is the commonality of commingled product. Gregariousness contrasts strongly with the loner disposition of the private hoarder.

Group activity can have positive social attributes, but the downside is peer pressures and adrenalin delusions associated with crowd mentality.⁹⁸ There can be very real dangers with strong leadership within such groups,

which can often lead to political behaviour. It was strong leadership over compliant Australian wool grower groups that led to the 4.75 million bale stockpile and AUD\$3 billion debt in 1991.⁹⁹

Despite the negativities of mediocrity and group reliance, some commodity pool users perceive themselves as innovative, respond to change, and may be early adopters of new marketing ideas.¹⁰⁰ This contrasts with the conservatism of the individual hoarder. However, innovation within a commodity pool system is unlikely to overcome the major disadvantages normally associated with such a selling and pricing method. There are alternatives after harvest.

10

CURRENCY AND RISK MANAGEMENT

Currency exchange can affect both the domestic and international transactions of all countries through imports, exports, price discovery and benchmarking, hedging, capital movement, and service industries. Differences in international price are the essence of trade.

If the majority of transactions including hedging were conducted in local currency, there would be no requirement to separate currency from price. The USA is one example where US dollar denominated domestic and international transactions largely occur, which results in small currency exposure and little need to manage currency risk. Currency becomes an important component of price whenever transactions or risk management are conducted in non-domestic currencies, or when there is a close correlation between the domestic price and a dominantly traded foreign currency such as the US dollar.

Domestic price relativity to international prices may increase the importance of local price and basis. Whenever a local commodity price is based on an international price, the local price seemingly has more importance through recognition and acceptance. International currency movement can then affect local transaction prices, basis risk, and hedging effectiveness.

A Canadian farmer storing wheat might perceive no currency risk because there is going to be a local sale in Canadian dollars. However, if the Canadian price is dependent on a Chicago price, then any movement in the CAD/USD rates will affect basis and therefore the local Canadian price. Therefore, the Canadian farmer storing wheat has upside CAD/USD

currency risk, as well as downside price risk if wheat prices fall.¹ Currency risk can exist even though no international trade is occurring.

Also, translation risk is an accountancy exposure associated with assets valued in another currency and made dependent on currency movement. If an asset was not readily saleable in the host country and convertible into foreign currency, then the asset might be seriously devalued from an accountancy perspective.²

Business risk arises when a domestic export business is viable under low exchange rates but may not be internationally competitive at high exchange rates because it is undermined by cheaper alternatives.³ Alternatively, a domestic import business that is viable under high exchange rates may not be internationally competitive at low exchange rates.

If price differences under different currency exchange rates drive international trade, the corollary may suggest that as prices and currency exchange differences converge then less international trade may occur,⁴ which could have implications or consequences for currency unions.⁵ However, the 'law' of one price remains contentious even for commodities,⁶ because price discrepancies and their volatility are measured through basis movement, and this regularly introduces hedging risk.⁷ It can be argued that if the 'law' of one price existed, then there would be no international hedging risk. Alternatively, international hedging risk undermines the theory of one price.

Countertrade, which mostly comprises product bartering, still remains as high as 25 percent of international trade and settlement because of currency shortages.⁸ Currency exchange risk is replaced by product exchange risk. A country that undertakes sufficient economic structural and fiscal reform might build up sufficient international currency reserves that could replace the need for countertrade.⁹

Currency leadership

In international monetary economies, both price and payment have to be agreed upon in a mutually acceptable currency denomination before a transaction can occur.¹⁰ A buyer might want to price in Yen and pay in Rouble, whilst the seller wants to price in Euros and be paid in Pounds. Mutually agreeable currency denomination can be a huge obstacle in international trade. The compromise may be that price and payment are transacted in US dollars.¹¹

Because the strength of trade is usually represented by currencies with continual large trade surpluses and the provision of credit from large currency reserves, there is a shift towards the Yuan-Renminbi, which is challenging the US dollar for leadership.¹² The paradox in international

trade is that weak economies undermine strong economies through low exchange rates.¹³ Exports from countries with strong currencies are weakened competitively relative to those countries whose export industries are encouraged by a weak currency.¹⁴ Conversely, countries with strong currencies have the advantage of cheaper imports relative to those countries whose imports are made more expensive by a weak currency.¹⁵

Any international currency benchmark for both spot and forward international trade decisions must have liquidity as reflected by the volume being transacted, availability to be transacted globally, security backed by a central reserve bank with adequate currency reserves, trust and confidence in the currency as a method of payment, and general freedom from manipulation, particularly through domestic government monetary policies.¹⁶ The US Dollar Index is an index based on a basket of major international currencies transacted regularly by the US, which has a liquid spot and forward futures market conducted by the Intercontinental Exchange (ICE).

Factors influencing currency exchange rates

Cycles in the US Dollar Index movement can induce approximately inverse cycles in other major currencies. Therefore, any factor that influences the US dollar cycle may often affect other currencies.¹⁷ There is never an exact inverse relationship because of trade and capital movement differences. Figure 10.1 depicts the approximate inverse relationship between the Euro and the USD Index between 1999 and 2013.

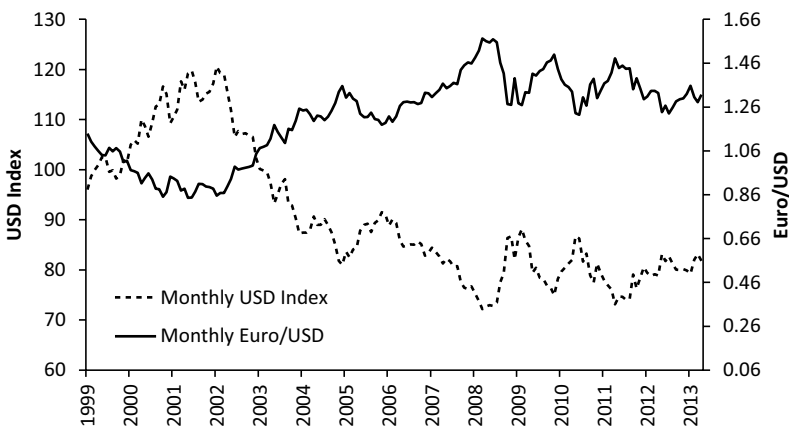


FIGURE 10.1 Monthly comparison of Euro/USD against USD Index: 1999–2013

Source: John Williams based on ICE futures prices sourced from PremiumData

Because price-taking commodities are generally priced in US dollars, any rise in the USD Index will place downside pressure on commodity prices, while any fall in the USD Index will tend to support commodity prices. Alternatively, movements in commodity prices and large international commodity transactions may change the USD Index.

Domestic interest rates relative to foreign interest rates affect international capital flows that influence the demand and supply of particular currencies.¹⁸ Capital inflows for domestic direct investment or government debt bond purchase will necessitate the buying of local currency and this will drive the currency up. In contrast, capital outflows for foreign direct investment or overseas government debt bond purchase will necessitate the sale of domestic currency and this will drive the local currency down.¹⁹ The risk: reward ratio can influence directional flow of capital between countries, and this may affect currency exchange rates.²⁰

Capital will generally flow out from a high inflationary country which could lower the currency exchange rate, but much depends on interest rate policy and trade flows.²¹ Higher interest rates can reflect lower domestic money supply which should reduce inflation, but high interest rates may also attract foreign capital which can force up the currency exchange rate. When exports are strong, high interest rates can support high currency rates, which will permit cheaper imports that may lower the inflation rate. There is an inter-relationship between the flow of capital and trade, interest rates, inflation, and currency rates.²²

If public debt is domestically financed through bond issue or increased taxation, the government may compete with the private sector over scarce investment sources, which tends to lower domestic private investment, weaken economic growth, and lower the exchange rate.²³ Alternatively, if government debt is largely financed from international sources, this may drive up short term domestic currency exchange rates because of the need to buy the local currency. However, much of the currency movement can depend on the international competitiveness of domestic exporters, import trade policies, and economic growth.

On the assumption that a country undertakes exports and imports in US dollars, any trade surpluses resulting from export income exceeding import expenditure requires a net purchasing of the domestic home currency, thus tending to force it up.²⁴ Greater success in export trade increases the upward pressure on the domestic currency exchange rate, which generally results in less international competitiveness and perhaps falling export demand in the future. Alternatively, greater success in import trade tends to increase the downward pressure on the domestic currency exchange rate,

which generally results in greater international competitiveness for domestic exports and perhaps rising export demand in the future. There may be an automatic balancing effect in trade flows.²⁵

Economic size will influence economic growth, capital investment, and trade, which may have more impact on currency exchange rates compared to a smaller country. However, an international currency reserve status and high currency rates for small countries such as Switzerland can be more dependent on economic stability, banking policies, and decentralization rather than mere economic size.²⁶

If domestic costs are higher relative to international benchmarks, there may be lower currency exchange rates due to export noncompetitiveness and trade deficits.²⁷ The corollary that low cost countries will have high currency exchange rates is not always upheld. Much depends on trade barriers, the extent of domestic competition for sustaining low costs, the international competitiveness of the export industries, the amount and direction of investment capital flows, and macroeconomic policies on inflation and interest rates.

Import barriers that are imposed because of revenue raising or industry protection generally weaken the international competitiveness of domestic industry with higher costs and lower competition, thereby tending to reduce currency exchange rates and thus making imports more expensive.²⁸ It has been common in the past for some governments to fix low currency exchange rates in lieu of increasing trade barriers. The alternative is economic and structural reform to ensure greater industry competitiveness, freer trade, and the potential for growth.²⁹

Economic shocks such as large defence or airline procurements require selling domestic currency, which can decrease the currency exchange rate.³⁰ War or civil disruption generally causes domestic currencies to fall, with exporters benefitting to the detriment of importers.³¹ In contrast, large stable exports can result in continual buying in the domestic currency exchange rate, which can drive up currency exchange rates.

Flexible exchange rates

A floating currency exchange rate mechanism under market deregulation and supply chain competition may automatically adjust the balance between export and import industries, albeit sometimes with large time lags.³² Whenever the rate rises, the balance tends to shift towards import industries and away from export industries, thus weakening the currency which ultimately benefits exports.³³ Alternatively, whenever the rate falls, the balance tends

to shift towards export industries and away from import industries, thus strengthening the currency which ultimately benefits imports.³⁴

Fixed exchange policies are unlikely to develop a liquid, transparent forward currency market.³⁵ Such forward currency markets are more likely to develop whenever floating currency rates create the risk of adverse exchange movement and the need for risk management.³⁶ Flexibility and the need for forward markets and risk management are the hallmarks of a floating currency exchange rate policy.

Fixed or regulated exchange rates

There is a long history of currency rates being regulated by central authorities or fixed through the price of gold, which benefitted those wanting trade protection.³⁷ However, fixing domestic currency whilst there were floating international currency movements could quickly erode any immediate benefit of trade controls, and cause domestic price distortions, cost inflation, and inefficiencies.³⁸ It is possible that the country can become even more reliant on import industries under fixed currency rates despite the supposed benefit for export industries, which then induces pressure for even greater import protective barriers.³⁹

Regulation of external trade and domestic supply chains can have a major impact on currency exchange rates. Attempts to decrease unemployment and inflation might involve regulating interest rates and wages in lieu of lower trade barriers and increased competition, which then requires controls over capital flows and currency rates. Fixed currency policies assume that variables can be sufficiently controlled so that the balance of trade, services, capital, and currency flows can reach some equilibrium within some monetary and fiscal parameters.⁴⁰ Microeconomic intervention policies can invariably lead to macroeconomic controls and lower economic growth, whilst monetary and fiscal policies become more aligned to supporting currency policy than good domestic governance.⁴¹

Fixing currency exchange rates assumes fixity of production inputs and outputs, which are highly variable in agricultural production. Production variation affects the dynamics of output and exports, as well as input and imports, and usually this has a serious impact on the balance of payments. Fixed currency exchange rate policies also assume constant capital flows in a very dynamic global capital market. Regulating currency exchange rates generally requires vast currency reserves, but these can dwindle due to increasing imports unless higher trade barriers are implemented.⁴²

Forward currency markets

Liquid transparent forward currency markets are required to facilitate international forward transactions as well as currency risk management. Without forward currency markets, there can be no forward risk management because of the difficulty in reaching exchange rate agreement between forward buyers and sellers. Speculators may be required to increase liquidity in forward currency futures markets, with market efficiency depending on some balance between speculators and hedgers.

Whereas forward capital markets factor in a forward cost of money that is reflected in the interest rate forward market, the forward currency market reflects the relative time value of money differences between countries as indicated by their different forward interest rates. Many factors can influence the spot currency rate but it is the relativity between domestic and foreign interest rates that determines the forward currency rate.⁴³ The efficiency of currency markets depends on convergence of the spot rate with the forward rate as time advances.⁴⁴ Table 10.1 indicates a sample of forward rates for the Euro/USD.

TABLE 10.1 Euro/USD monthly forward rates—an indicative sample

<i>Month</i>	<i>Rate</i>
June	1.2831
September	1.2840
December	1.2850
March	1.2863
June	1.2877
September	1.2892

If the domestic interest rate is higher than the foreign interest rate, then the forward month currency rates will be at a discount to the spot market rate. Alternatively, if the domestic interest rate is lower than the foreign interest rate, then the forward month currency rates will be at a premium to the spot market rate. In Table 10.1, the premium in the Euro/USD forward months suggests that the interest rates in the EU are lower than those in the USA.

As a general example, assuming that the spot rate is 0.80, if the domestic interest rate in twelve months' time is 5 percent, and the foreign interest rate in twelve months' time is 1.5 percent, then the forward rate in twelve

months' time is 1.015 divided by 1.05 multiplied by 0.80 equalling 0.7733. Alternatively, it can be expressed as follows:

$$\begin{aligned}\text{Forward currency rate} &= (\text{Spot currency rate} \times \text{foreign interest rate}) / \\ &\quad \text{domestic interest rate} \\ &= (0.80 \times 1.015) / 1.05 \\ &= 0.7733\end{aligned}$$

In contrast, assuming that the spot rate is 0.80, if the domestic interest rate in twelve months' time is 1.5 percent and the foreign interest rate in twelve months' time is 5 percent, then the forward rate in twelve months' time is 1.05 divided by 1.015 multiplied by 0.80 equalling 0.8276. If the domestic interest rate is lower than the foreign interest rate, then the forward month currency rates will be at a premium to the spot market rate. Alternatively, it can be expressed as follows:

$$\begin{aligned}\text{Forward currency rate} &= (\text{Spot currency rate} \times \text{foreign interest rate}) / \\ &\quad \text{domestic interest rate} \\ &= (0.80 \times 1.05) / 1.015 \\ &= 0.8276\end{aligned}$$

The forward currency exchange market assumes market efficiency in each country with no permanent distortions occurring, and that arbitrage will correct any temporary discrepancies.⁴⁵

Currency risk

An advantage of central authorities fixing currency rates is that responsibility for currency risk management can be transferred to the central authority, but large currency changes can still occur only less frequently.⁴⁶ In contrast, there will be more frequent currency risk involved with trade, capital, investment, and hedging whenever floating currency exchange rates apply.⁴⁷

Producers and exporters have a short domestic currency market position and upside currency risk. If Brazilian corn exporters receive US dollars as part of the international sale transaction, then they will be long in US dollars and their risk will be if the US dollar falls. What Brazilian exporters usually need is Real as domestic currency. Therefore, they will be short in Brazilian Real with the risk being on the upside.

If current corn international port prices are US \$300 per tonne, Brazilian corn producers would be paid in US dollars and receive Real 625 per tonne at 0.48 Real/USD, and only Real 577 per tonne at 0.52 Real/USD. Domestic price equates to the foreign price divided by the currency rate. Therefore, as the currency exchange rate rises, domestic producers and exporters receive less domestic currency, on the assumption that they are international commodity price takers.

Alternatively, end users who rely on imports will have downside domestic currency risk. If Chinese soybean importers hold Yuan currency as part of the international transaction, then they will be long in domestic currency. Their risk will be if the Yuan falls. What importers usually need is US dollars. Therefore, they will be short in US dollars with the risk being on the upside if the US dollar rises.

If Chinese soybean importers need to pay US \$500 per tonne, this would require Yuan 2994 per tonne at 0.167 Yuan/USD, and Yuan 3846 per tonne at 0.13 Yuan/USD. Therefore, as the currency exchange rate falls, domestic end users pay more, on the assumption that they are international commodity price takers.

Strategies to minimise currency risk

Currency risk minimization can occur despite there being no transfer of currency risk.⁴⁸ The larger the organization and the globalization of operations, the more likely currency risk minimization will be attempted.

Many banks can establish US dollar trading accounts for clients. It is common even for clients of futures brokers to have US dollar accounts through their Clearing Members, particularly when there are daily margin settlements in US dollars. This removes short term risk in currency movement that could result in higher transaction costs, but there is downside risk in the longer term if the US dollars need to be converted back into domestic currency. The alternative is to import goods or services and pay in US dollars.

Currency exposure can be minimised through offsetting transactions during the day, which might be described as unintentional internal hedging. Currency exposure valuations are netted out at the end of each day, which may be difficult when there are 24 hour operations across several time zones.⁴⁹ A decision has to be made daily at some point in a global zone time as to whether this net daily currency risk exposure should be offset and hedged externally or internalised.⁵⁰

Transacting in 'stable' currencies generally refers to transacting in more common currencies such as the US dollar, Yen, Euro, or Pound which have liquid deregulated markets and are less inclined to be manipulated. An international seller might be paid in a currency that is not 'stable' which then cannot be exchanged normally because of illiquidity and may have to be severely discounted to convert it to other international currencies.

Currency risk management

Currency risk management involves the deliberate offsetting (hedging) of market position, similar to the management of price risk. A producer or exporter who is short in domestic currency will hedge by going long, and establish a long currency hedge.⁵¹ Alternatively, an importer who is long in domestic currency will hedge by going short, and establish a short currency hedge.⁵²

Whilst it is possible for individuals to manage currency risk through non-bank methods, it is more usual to use bank products to manage currency risk, especially when they are combined with price risk management. This enables the bank to offer hedged prices in domestic currency. Five categories of currency risk management strategies will be examined separately, which include forward contracts, futures hedging, ceilings and floors, and collars.

Forward exchange contracts (FECs)

Currency forward contracts issued by banks to clients are also known as foreign or fixed exchange contracts, and all major currencies can be locked in under such contracts with time periods tailored to the client's needs. FEC contracts are flexible with delivery, which means that the client can settle with cash at any time with the bank, or they can be delivered against with physical currency on or before contract maturity time. This means that the bank assumes default and cash settlement until contract maturity, unless physical currency delivery occurs.

Forward exchange contracts can be delivered against which results in receiving the currency exchange rate that was locked in the contract. If delivery does not occur, then there will be cash settlement against the contract depending on the directional movement of the currency. The debits and credits associated with cash settlement depend on whether the client is an exporter who is short with currency risk on the upside, or an importer who is long with currency risk on the downside. Settlement is the difference between the locked in rate and the market rate.

Delivered against FEC contract. Assume a European exporter is short in Euro/USD with upside risk and locks in US\$1,000,000 currency

at Euro €1.25 for six months with an FEC. On the assumption that the physical US dollars are delivered against the FEC at the maturity date, the security deposit made by the exporter to the bank is €300,000, and if the Euro/USD has risen to €1.50 at maturity of the FEC, the following is the transaction process:

Exporter obliged to sell US\$1m to bank at €1.25	= €800,000
Exporter physically delivers US\$1m to bank	
Bank deposits €800,000 into Exporter's account	
FEC obligations completed	
Exporter's account balance + security deposit	= €1,100,000

Alternatively, assume a European importer is long in Euro/USD with downside risk and locks in US\$1,000,000 currency at Euro €1.25 for six months with an FEC. On the assumption that the physical US dollars are accepted against the FEC at the maturity date, the security deposit made by the exporter to the bank is €300,000, and that the Euro/USD has risen to €1.50 at maturity of the FEC, the following is the transaction process:

Importer obliged to buy US\$1m from bank at €1.25	= – €800,000
Importer physically takes delivery of US\$1,000,000	
Bank deposits US\$1m into Importer's account	
FEC obligations completed	
Importer's balance + security deposit =	
	US\$1,000,000 + €300,000

Cash settled against FEC when currency rises. On the assumption that the previously intended international sale fails to eventuate, then the exporter with a FEC can cash settle at any time with the bank. Again assume the European exporter is short in Euro/USD with upside risk and locks in US\$1,000,000 currency at Euro €1.25 for six months with an FEC. On the assumption that the security deposit made by the exporter to the bank is €300,000, and the Euro/USD has risen to €1.50 and is cash settled at maturity of the FEC, the following is the transaction process:

Exporter obliged to sell US\$1m to bank at €1.25	= €800,000
Exporter cancels physically delivery of US currency	
Current spot market purchase US\$1m at €1.50	= €666,667

204 Currency and risk management

Bank deposits €133,333 into exporter's account

FEC obligations completed

Exporter's account balance = €433,333

Alternatively, on the assumption that the previously intended international purchase fails to eventuate, then the importer with a FEC can cash settle at any time with the bank. Again assume the European importer is long in Euro/USD with downside risk and locks in US\$1,000,000 currency at Euro €1.25 for six months with an FEC. On the assumption that the security deposit made by the importer to the bank is €300,000, and the Euro/USD has risen to €1.50 and is cash settled at maturity of the FEC, the following is the transaction process:

Importer obliged to buy US\$1m from bank at €1.25 = €800,000

Importer cancels physical delivery of US currency

Current spot market sale of US\$1m at €1.50 = €666,667

Bank withdraws €133,333 from importer's account

FEC obligations completed

Importer's account balance = €166,667

Cash settled against FEC when currency falls. On the assumption that the previously intended international sale fails to eventuate, then the exporter with a FEC can cash settle at any time with the bank. Again assume the European exporter is short in Euro/USD with upside risk and locks in US\$1,000,000 currency at Euro €1.25 for six months with an FEC. On the assumption that the security deposit made by the exporter to the bank is €300,000, the Euro/USD has fallen to €1.10 and is cash settled at maturity of the FEC, the following is the transaction process:

Exporter obliged to sell US\$1m to bank at €1.25 = €800,000

Exporter cancels physical delivery of US currency

Current spot market purchase US\$1m at €1.10 = €909,090

Bank withdraws €109,090 from exporter's account

FEC obligations completed

Exporter's account balance = €190,910

Alternatively, on the assumption that the previously intended international purchase fails to eventuate, then the importer with a FEC can cash settle at any time with the bank. Again assume the European importer is long in Euro/USD with downside risk and locks in US\$1,000,000 currency at Euro €1.25 for six months with an FEC. On the assumption that the security deposit made by the importer to the bank is €300,000, the

Euro/USD has fallen to €1.10 and is cash settled at maturity of the FEC, the following is the transaction process:

Importer obliged to buy US\$1m from bank at €1.25	= €800,000
Importer cancels physical delivery of US currency	
Current spot market sale US\$1m at €1.10	= €909,090
Bank deposits €109,090 into importer's account	
FEC obligations completed	
Importer's account balance	= €409,090

Currency futures hedging

Similar to commodity futures hedging, the physical position is offset with a futures position in a currency hedge.⁵³ However, the advantage of currency hedging is that there is little basis risk because of the homogeneity of currency and there is no currency risk as would be the case for international commodity futures hedging.⁵⁴ Currency is the one pure commodity which cannot be legally differentiated, which improves hedge effectiveness.⁵⁵ However, currency hedging can only be undertaken if there is a liquid currency futures market, with transaction costs largely depending on the slippage between bid: offer spreads.⁵⁶

TABLE 10.2 Currency futures hedge for exporter if domestic currency rises

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>
Today	Exporter short intending to sell USD 450,000 = BRL 1,000,000 @ 0.45 in 6 months' time	Buys 10 BRL/USD futures contracts @ 0.45 BRL 1m = USD 450,000
6 months' time	Exporter sells USD 450,000 @ 0.5 = BRL 900,000	Sells 10 BRL/USD futures contracts @ 0.5 BRL 1m = USD 500,000
Hedge outcome		Profit = US\$500,000 – \$450,000 = US\$50,000 @ 0.50 = BRL 100,000
	Realized value = Spot + Futures profit = BRL 900,000 + 100,000 = BRL 1,000,000	
	Effective rate = USD 450,000/ BRL 1 m = 0.45	

If a Brazilian exporter is short in Real/USD (long in USD) with upside currency risk for US\$450,000 over the next six months, the exporter could establish a long BRL/USD currency hedge at 0.45. Table 10.2 indicates the the hedging transaction process on the assumption that the BRL/USD has risen to 0.50 in six months' time, the contract size is BRL100,000 and brokerage is ignored.

The realized or effective currency rate from the hedge was BRL = USD 0.45. This was a perfect hedge because there was no basis movement during the hedge with a 100 percent hedge ratio. However, there were daily margin settlements to consider in transaction costs. A risk arises if the sale does not eventuate and the Brazilian exporter does not receive the USD\$450,000 in six months' time to enable exchange into Brazilian Real. Taking out buy futures when there is not an equal and offsetting physical market position is speculation. If the USD transaction fails to eventuate and the BRL/USD falls, then the exporter loses on the buy BRL/USD futures contracts in speculation.

Alternatively, Table 10.3 indicates the transaction process for the Brazilian exporter if the BRL/USD had fallen to 0.40.

TABLE 10.3 Currency futures hedge for exporter if domestic currency falls

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>
Today	Exporter short intending to sell USD 450,000 = BRL 1,000,000 @ 0.45 in 6 months' time	Buys 10 BRL/USD futures contracts @ 0.45 BRL 1m = USD 450,000
6 months' time	Exporter sells USD 450,000 @ 0.4 = BRL 1,125,000	Sells 10 BRL/USD futures contracts @ 0.4 BRL 1m = USD 400,000
Hedge outcome		Loss = US\$450,000 – \$400,000 = US\$50,000 @ 0.40 = BRL 125,000
	Realized value = Spot – Futures loss = BRL 1,125,000 – 125,000 = BRL 1,000,000	
	Effective rate = USD 450,000/ BRL 1 m = 0.45	

The realised or effective currency rate again was $\text{BRL} = \text{USD } 0.45$, which was a perfect hedge because there was no basis movement during the hedge with a 100 percent hedge ratio. It might be questioned as to why currency futures were required when currency fell for the exporter and losses were incurred in the futures account. A better alternate hedging strategy might be a buy call currency options hedge, but there is a premium to consider.⁵⁷

In contrast, if a Brazilian importer is long in Real/USD (short in USD) with downside currency risk for USD\$450,000 over the next six months, the importer could establish a short BRL/USD currency hedge at 0.45. Table 10.4 indicates the transaction process. Table 10.4 indicates the transaction process on the assumption that the BRL/USD has risen to 0.50 in 6 months time, the contract size is BRL 100,000 and brokerage is ignored.

The realised currency rate was $\text{BRL} = \text{USD } 0.45$. This was a perfect hedge because there was no basis movement during the hedge with a 100 percent hedge ratio. However, there were daily margin settlement losses in the

TABLE 10.4 Currency futures hedge for importer if domestic currency rises

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>
Today	Importer long intending to buy USD 450,000 = BRL 1,000,000 @ 0.45 in 6 months' time	Sells 10 BRL/USD futures contracts @ 0.45 BRL 1m = USD 450,000
6 months' time	Importer buys USD 450,000 @ 0.5 = BRL 900,000	Buys 10 BRL/USD futures contracts @ 0.5 BRL 1m = USD 500,000
Hedge outcome		Loss = US\$500,000 – \$450,000 = US\$50,000 @ 0.50 = BRL 100,000
	Realized value = Spot + Futures loss = BRL 900,000 + 100,000 = BRL 1,000,000	
	Effective rate = USD 450,000/ BRL 1 m = 0.45	

futures hedge account when currency rose. Using short currency futures hedging might be questionable for the importer when currency rises because of transaction losses, but this is similar to the cash settlement losses of the FEC. Meeting daily margin settlement losses with the potential for margin calls is the biggest disadvantage of using a currency futures hedge. However, the attractiveness of currency futures remains, provided that there is a strong downward trend in currency movement.

Implementing a buy put currency options hedge would have removed the margin losses on the sell futures in this situation, and provided a floor with upside gain potential. This currency protection plus flexibility is the best of both worlds, but there is an options premium to consider.⁵⁸ Each of the hedging strategies has strengths and weaknesses.

Alternatively, Table 10.5 indicates the transaction process for the Brazilian importer if the BRL/USD had fallen to 0.40. The realized or effective currency rate was BRL = USD \$0.45. This was another example of perfect hedge because there was no basis movement during the hedge with a 100 percent hedge ratio. The advantage for the importer with falling domestic currency is that there are no futures hedge account losses.

TABLE 10.5 Currency futures hedge for importer if domestic currency falls

<i>Time</i>	<i>Physical Market</i>	<i>Futures Market</i>
Today	Importer long intending to buy USD 450,000 = BRL 1,000,000 @ 0.45 in 6 months' time	Sells 10 BRL/USD futures contracts @ 0.45 BRL 1m = USD 450,000
6 months' time	Importer buys USD 450,000 @ 0.4 = BRL 1,125,000	Buys 10 BRL/USD futures contracts @ 0.4 BRL 1m = USD 400,000
Hedge outcome		Profit = US\$450,000 – \$400,000 = US\$50,000 @ 0.40 = BRL 125,000
	Realized value = Spot – Futures profit = BRL 1,125,000 – 125,000 = BRL 1,000,000	
	Effective rate = USD 450,000/ BRL 1 m = 0.45	

Selling currency futures were required for the importer when the currency fell. The profit gained through the sell currency futures position perfectly offset the losses in the physical currency market. There were added advantages in using the short currency futures hedge because there was full control over the position, exiting was possible at any time, and there was no need to transact the physical delivery.

However, the time frame of the currency hedge was limited to the liquidity in the forward currency futures months, which often is no more than 12 months. This contrasts to a bank FEC which might extend the duration of the currency hedge for at least 3 years. Another problem becomes one of knowing that currency is going to fall in advance of hedging decision making.⁵⁹ The advantages of currency futures hedging become somewhat negated when currency directional movement is uncertain. This results in the potential for futures margin losses for most of the time.

Currency options hedging

Options on currency futures were introduced to reduce margin risk when hedging against currency risk, which is the same reason as commodity options were introduced.⁶⁰ However, there is little basis and currency risk as would be the case for international commodity options hedging. The disadvantage lies in the cost of the options premium, which sometimes is perceived to be prohibitive. Therefore, the selection of the strike price is an important consideration in the usage of currency options. In contrast to many currency futures markets, currency options transactions are often restricted because of market liquidity.⁶¹ The trade-off between options sellers perceiving high currency risk and wanting higher premiums is frequently not matched by options buyers actually perceiving the same risk and being willing to pay for such high premiums.⁶²

Currency ceilings and long collars. Ceilings and long collars can be used for exporters who have upside currency risk. As an example, if a Canadian exporter is short in CAD/USD (long in USD) with upside currency risk for USD \$1,000,000 over the next six months, the exporter could establish a currency options hedge with a buy at the money CAD/USD call at a strike price of CAD\$1.01 for CAD\$0.01 premium. Table 10.6 indicates the buy call hedge transaction process, assuming that the CAD/USD has risen to 1.08 in six months time, the current CAD/USD exchange rate is 1.01, the contract size is CAD 100,000, and brokerage is ignored.

TABLE 10.6 Currency options hedge for exporter if domestic currency rises

<i>Time</i>	<i>Physical Market</i>	<i>Options Market</i>
Today	Exporter short intending to sell USD \$1 million = CAD \$990,099 @ 1.01 in 6 months' time	Buys 10 CAD/USD at-the-money calls for CAD 0.01 Premium = $0.01 \times 10 \times 100000$ = CAD \$10,000 Cap/ceiling = Approx. CAD 1.02
6 months' time	Exporter sells USD 1 million @ CAD 1.08 USD \$1 million = CAD \$925,925	Exercise buy calls @ CAD 1.01
Hedge outcome		US \$1m @ 1.01 = CAD \$990,099 US \$1m @ 1.08 = CAD \$925,925 Intrinsic value = CAD \$64,174 Less options premium = CAD \$10,000 Options profit = CAD \$54,174
	Realized value = Spot + Options profit = CAD \$925,925 + \$54,174 = CAD \$980,099	
	Effective rate = USD \$1 m/ CAD \$980,099 = CAD 1.02	

Therefore, the ceiling or effective rate for the exporter is approximately CAD\$1.02, beyond which the exporter has upside protection through the buy call options. The exporter achieves unlimited downside gain, but there is the cost of the buy call options premiums. If the CAD/USD had not risen above CAD/USD\$1.01 or had fallen below CAD/USD\$1.01, then the buy CAD/USD call options would expire worthless. The exporter would then realise the market rate plus the buy call options premium of CAD\$10,000.

Alternatively, if the exporter used a zero cost OTC long collar⁶³ with the same ceiling of 1.02 through the buy call option, but with the premium now being offset by a sell CAD/USD put at \$0.99, then the previous downside currency gain would cease at CAD\$0.99 by the floor established by losses through selling put options.

TABLE 10.7 Currency options hedge for importer if domestic currency falls

<i>Time</i>	<i>Physical Market</i>	<i>Options Market</i>
Today	Importer long intending to buy USD \$1 million = CAD \$990,099 @ 1.01 in 6 months' time	Buys 10 CAD/USD at-the-money puts for CAD 0.01 Premium = $0.01 \times 10 \times 100000$ = CAD \$10,000 Floor = Approx. CAD 1.00
6 months' time	Importer buys USD 1 million @ CAD 0.96 USD \$1 million = CAD \$1,041,667	Exercise buy puts @ CAD 1.01
Hedge outcome		US \$1m @ 0.96 = CAD \$1,041,667 US \$1m @ 1.01 = CAD \$990,099 Intrinsic value = CAD \$51,568 Less options premium = CAD \$10,000 Options profit = CAD \$41,568
	Realized value = Spot – Options profit = CAD \$1,041,667 – \$41,568 = CAD \$1,000,099	
	Effective rate = USD \$1 m/ CAD \$1,000,099 = CAD 1.00	

Currency floors and short collars. If a Canadian importer is long in CAD/USD (short in USD) with downside currency risk for USD\$1,000,000 over the next six months, the importer could establish a currency options hedge with a buy at the money CAD/USD put at a strike price of CAD\$1.01 for CAD\$0.01 premium. Table 10.7 indicates the transactions assuming the CAD/USD has fallen to 0.96 in six months time, the current CAD/USD rate is 1.01, the contract size is CAD 100,000, and brokerage is ignored.

The floor for the importer is CAD 1.00, below which there is downside protection through the buy put options. There is unlimited upside gain, but there is the premium cost of the buy puts. If the importer used a zero cost OTC short collar with the same floor of 1.00 being offset by a sell CAD/USD call at 1.03, then the previous upside currency gain would cease at CAD 1.03 by the ceiling established by losses on selling call options.

11

LIMITATIONS IN MANAGING RISK

Increased risk usually involves an individual choice between acceptance or avoidance. A farmer or end user is usually not forced to undertake business in a particular locality. However, to accept risk as a risk taker and then to expect risk management to minimize that risk may be perceived to be contradictory.

Alternatively, a risk-averse individual who may be more willing to accept risk management might have chosen to avoid the initial risk. Psychological consistency would suggest a risk taker to maintain risk taking at least in the short term, while a risk avoider would be expected to continue to avoid risk taking. This suggests that adoption of risk management practices by those who choose to accept additional risk such as dry-land farming may therefore be very difficult and may be perceived as contradictory.¹

Risk: return theory assumes that there will be the potential for high reward for the risk undertaken.² It assumes that risk will be minimized for any given return, or that returns can be maximized for any given risk. But what if the production risk for a dry-land farmer is always high and cannot be controlled, and the probability of high returns as expressed through positive price skewness is low and cannot be managed through sufficient price volatility?³ Theory would suggest that the dry-land farmer with a product that has low price volatility and positive price skewness has chosen to be beyond the acceptable risk: return efficiency frontier.

Short hedging of prices might be expected to have a high probability of success for a farmer because of the propensity of prices to be low

with positive skewness. But this supposition assumes that there is sufficient price risk for risk management to be adequately rewarded. If periodic price volatility is not sufficient to provide adequate net returns on risk management after transaction costs, then price risk management is unlikely to occur.⁴ Sufficient price volatility is required to provide adequate returns from price risk management. To criticize agricultural price volatility when there is positive price skewness is to doom price risk management and farmer profitability.⁵

One conclusion is that price risk management is unlikely to be adopted by dry-land farmers with high production risk because it does not provide sufficiently high returns due to low price volatility.⁶ Price risk management is more likely to be adopted by irrigated farmers with low production risk because it complements high income returns due to assured production.⁷

High preharvest production risk can frequently result in postharvest product retention with supply chain risk, despite there being no change in the propensity for low returns as expressed through positive price skewness and low price volatility. If farmers with high production risk cannot achieve adequate returns preharvest, then they will be more likely to seek adequate returns postharvest by extending the time period.⁸

However, merely extending the time period when there are no changes to price skewness and volatility will not achieve the expected returns for farmers, particularly when the postharvest cost of money and storage costs are considered. Whereas hedging will not maximize price returns postharvest because of transaction costs, price speculation after harvest is unlikely to provide sufficient long-term returns to offset the preharvest production risk.

This is the commodity poverty trap dilemma encountered by most global dry-land farmers, particularly when costs are rising faster than prices, and despite rising food demand which seemingly can coexist with lower farm prices. Small productivity gains on farms do not increase financial returns without profitability. The solution for such farmers may not be risk management or subsidies that would entrench the dilemma and delay the inevitable, but to seek alternate farm enterprises that are more risk efficient with a higher return for lower risk.⁹

The situation for the end user varies widely, with much depending on the importance of the input: output value ratio. High delivery risk combined with input dependency due to a high input: output value ratio usually represents high risk for an end user, but if this resulted in high returns as expressed through the difference between the positively skewed input price and a much higher final output price, then the high risk: high return combination might be acceptable to the end user as being risk efficient.

Alternatively, if the delivery risk for an end user decreased because of supply chain alignment with irrigated farmers, then a low risk: high return would be even more acceptable in risk efficiency despite input dependency remaining high. Price risk management is unlikely to dramatically change the outcome or risk efficiency of an end user unless it can be timed to provide price protection in the unlikely event of sharply rising prices. Positive price skewness provides some natural protection for an end user, so much so that the danger signals of decreasing carry or increasing backwardation in the forward market may not be recognized early enough.

Limiting market factors

The corollary of some of the adoption criteria discussed in Chapter Three are often reasons for limiting price risk management. However, there are some market factors that can limit price risk management.

There needs to be sufficient price uncertainty to create sufficient market liquidity that would increase opportunities and reduce transaction costs. If price movement is perceived to be relatively certain, few sellers or short hedgers would want to sell or price into a rising market, and few buyers or long hedgers would want to buy or price into a falling market. Ironically, price volatility as measured by the frequency of movement is lowest with strongly trending markets, and can be highest in poorly trending markets, which results in standard deviation not being an adequate measure of volatility.

Whilst the probability of strongly trending markets is low because of severe positive skewness in most agricultural commodities, there may be a higher incidence of price uncertainty at the lower price end of the market, which may be of some limited benefit to hedgers. Some farmers may even perceive the relative certainty of low prices as a disincentive to manage price, particularly when costs of production are higher than price, which might then question the whole rationale for farming.¹⁰ If managing price risk is questionable, then it could be that the farm business is also questionable.

Strong price volatility creates both the perception of risk and opportunism, which may result in acceptable risk: return ratios for both buyers and sellers.¹¹ High market liquidity can arise when both hedgers and speculators perceive price to be relatively uncertain, which contrasts with the lower risk and lesser opportunism with price stability. Much hedging activity by farmers, merchants, and end users may result from opportunistic behaviour rather than from any real commitment to risk management, but the outcomes may be greater financial viability and longer term sustainability in food and fibre supply chains.¹²

Any transaction cost is invariably commensurable with the amount of risk and the type of risk management.¹³ Costs can be incurred directly through outlays or indirectly through opportunity costs and trade-offs.¹⁴ Assuming that the primary risk relating to price can be managed, new risks can increase the transaction cost of risk management, such as delivery, basis, currency, default, cash settlement, asset security deposits, and the cost of money. Management of secondary risks and costs may be required, or alternate strategies selected.

A dry-land farmer with high debt, low cash flow, and a profit margin of less than one percent is highly unlikely to meet hedging transaction costs.¹⁵ Whilst managing price risk may assist profitability, there must be some existing profit to meet hedging transaction costs.¹⁶ In contrast, profitable irrigated cotton growers can budget up to four percent of their gross income for transaction costs associated with either hedging or enhancing their price.¹⁷

Markets and associated hedging activities can be limited by any factor that encourages private hoarding. Direct farm subsidies provide cash flow that can increase the propensity to defer sales and withhold supply from the supply chain.¹⁸ It may be argued that the added security of subsidized cash flow and crop insurance might provide greater opportunities to hedge or enhance price, however there is little evidence for this correlation.¹⁹

Inadequate offsetting mechanisms

Liquid forward markets must exist to offset forward position risk and to adequately provide price signals to make appropriate tactical decisions.²⁰ Factors that encouraged the development of forward markets in Chapter Two could be inadequate and thus prevent price risk management.

Forward markets must be correctly aligned with a time period such as the start and finish of a new crop year so that carry can be established in forward months for stored inventories. There must be clear delineation between an old crop year and a new crop year, which requires consensual agreement between merchants and end users as well as between different commercial trade markets. Differing crop dates between merchants and end users dilute the impact of forward prices and weakens the foundation of a liquid forward market.

The problem for farmers in different geographic latitudes is deciding whether to hedge off old or new crop years. This is exacerbated between northern and southern hemispheres where farmers have little alternative than to hedge new crop in old crop futures markets in the opposite

hemisphere, while merchants are forced to hedge old crop in new crop futures markets.²¹ With basis risk so variable under such circumstances, it may be understandable why farmers do not undertake any price risk management and prefer hoarding alternatives.

Basis risk can also vary tremendously between different products and futures markets, sometimes depending on whether the physical delivery locations are port-based or up-country, which makes generalizations over hedge effectiveness very difficult. However, there can be seasonal basis movements which offer opportunities to both long and short hedgers.

One fundamental problem with futures markets is that they can become hybridized between the actual old crop commercial forward trade market that is their foundation, and the anticipatory new crop estimations that are driven by forecasting speculators.²² Such distortions decrease old crop forward market relevancy for end users and merchants, whilst aiding and abetting opportunistic farmers under the guise of hedging, albeit with high basis risk.²³

If futures markets were never designed for hedging by farmers either for new crop or old crop storage,²⁴ the irony is that much of the price risk management activity by farmers is based on an anticipatory speculative forward estimated price prior to harvest, which is global weather-driven,²⁵ and hybridized with an old crop local commercial trade forward price with contango or backwardation conditions that are easily distorted by spread traders in the futures market.²⁶ Effective new crop forward hedging by farmers in a supposedly efficient old crop forward market becomes problematical at best, and with high basis risk at worst.²⁷

In addition, futures markets were never designed for foreigners, despite the preponderance of usage by international hedgers and speculators.²⁸ Hedging domestic new crop off a foreign old crop futures market increases basis risk and introduces new risks such as adverse currency movement.²⁹ Daily currency conversions in the futures trading account increase the transaction cost, unless the trading account is converted to the same denomination as the futures market, or the futures trading account is designed to be settled in domestic currency.

Whereas there is basis convergence in forward currency markets because of interest rates standardizing the cost of future money, factors such as basis, carry, backwardation, and monthly spread distortions are highly variable in any deliverable agricultural forward market. Whilst it may be possible to deliver against a futures contract and receive the earlier locked-in price, this is little consolation to those who cannot deliver and must close out at a price that bears little similarity to their own physical price.³⁰ Although basis risk

has been a concern for Washington legislators for nearly 100 years,³¹ many local US merchants and end users have still been able to deliver against the futures contract in the delivery period.

There is a solid argument for the existence of any forward market that has some liquidity, relevancy, public transparency, and anonymity to facilitate forward transactions and to manage supply chain risk. Any forward market that is untainted by corruption or monopoly influence is often better than no forward market.³² The cost of not having forward markets is very real, but difficult to value in terms of opportunities foregone.

Most pulse crops in southern Asia lack transparent spot markets and are devoid of liquid forward markets, with traders generally prevented from offsetting risk despite the relatively secured crop production and product storability.³³ A general lack of liquid transparent spot and forward markets can therefore be a disincentive for many domestic and international transactions and a discouragement for price risk management.

Factors preventing a futures market

There are many prerequisites in the development of futures markets, but there also can be many inhibiting factors.³⁴ Issues such as cash-settled contracts and product perishability are important enough to be discussed separately after this section.

There is an expectation by some individuals and governments that forward markets and the ability to hedge are a natural occurrence.³⁵ The presence of so many illiquid global futures markets with forward market inadequacies and ineffectual hedging is indicative of problems with supply chain inefficiency.³⁶ A majority of the most successful US forward markets for storable agricultural products were established in the latter half of the nineteenth century.

The inability to establish new liquid local relevant agricultural futures markets globally over the past 120 years can be a concern for risk managers, however, the benefits versus costs of risk management have been questioned for some time,³⁷ particularly when positive price skewness may have increased. Hedging requires risk reduction, and not just merely interchanging with other risks that might result in overall increased risk. Inadequacies in forward markets to effectively manage risks within deregulated supply chains can encourage advocacy for reregulation.³⁸

There can be no effective agricultural futures market without an active underlying spot physical market.³⁹ Food and fibre futures markets cannot be created out of virtuality because they involve tradeable, transferable physical

forward contracts that require physical settlement either with cash or a delivered product specified by the underlying commercial trade market.⁴⁰ It is a misconception to assume that if futures markets are permitted to develop by themselves under deregulation, then this will somehow encourage local commercial industry clustering and trade markets to develop. Alternatively, a forward futures market should not be attempted merely because of delivery defaults and credit risk in local forward contracting.⁴¹ There has to be an existing sustainable local commercial trade market before any relevant effective futures market can be established.

Agricultural futures markets must be based on physical spot markets that have relevancy to those undertaking transactions and some consistency of transactions in terms of product similarities and lot sizes, combined with some regularity of transaction turnover that induces liquidity.⁴² The spot market mechanism must have active buyers and sellers who are both willing and able to consummate immediate physical transactions. Buyers require a need to buy backed up by an ability to pay, while sellers have to be willing to sell backed up by the ability to physically deliver the specified product.

The occasional transaction of different products in different localities is unlikely to support the development of a spot market and extremely unlikely to support the physical delivery requirements of a liquid futures market,⁴³ irrespective of the economic development status of a country.⁴⁴ Without an efficient and transparent physical commercial spot market, there can be no foundation for an agricultural forward physical or futures market through the provision of carry.⁴⁵

An effective agricultural futures exchange should be reflecting prices that have been established in the underlying commercial trade market, rather than 'discovering' prices, otherwise there could be serious basis issues.⁴⁶ If spot futures prices are 'discovered' on a futures market, then they may be largely speculative, irrelevant, and meaningless from a supply chain perspective, and may be a poor conveyor of signals to producers, buyers, and sellers.⁴⁷

How the commercial trade market is defined usually establishes the scope of the futures market and the limits of its effectiveness.⁴⁸ The commercial trade market for raw sugar No. 11 futures on the Intercontinental Exchange (ICE) is expansively based on all the major global exporting port markets. The commercial trade market for ICE coffee futures is also extensive, representing all the major global importing port markets. Both of these futures markets could include more international ports in the future. Therefore, the inclusiveness and exclusiveness of the futures market actually begins when the commercial trade market is defined for the purpose of basing a futures market.⁴⁹

This can be contrasted to the US corn futures market, which is confined to the US Corn Belt but which is extremely diverse in the underlying commercial trade submarkets. These include animal feed and the manufacturing of food products, ethanol, industrial alcohol and starch, bourbon, and syrup. Any separate futures contract within a commercial corn trade submarket can fail,⁵⁰ but it has had a successful outcome as a whole market. However, the up-country Chicago corn contract price may have only limited relevancy for a US corn exporter at down-river New Orleans, because of the variability of transport and grade basis.⁵¹

An agricultural futures market can have a liquid spot month, but lack liquidity in the forward market, which hinders forward transactions as well as preventing hedging activity and signalling to guide forward decision making. This is common in countries such as Australia which do not have strong centralized commercial forward markets that are based on definable warehouse space.⁵² Ironically, wool has the required definable centralized warehouse space in Australia but buyers are mostly unwilling to pay carry or undertake forward transactions because of the spot market auction system that favours selling agents and wool hoarding.⁵³

As indicated with the wool example, product storability does not always translate into successful forward markets. Tea may be storable, but it has never successfully transposed warehousing into a commercial forward market that might support an effective futures market, because buyers want fresh smell and taste which deteriorates with storage time.⁵⁴ Similarly, aroma and texture factors can limit tobacco storage despite its storability. Coffee bean is storable with a highly liquid forward futures market, whilst roasted coffee does not. If there is no forward value for a commercially traded product, theoretically there should be no forward futures market.⁵⁵ Tea, tobacco, and roasted coffee might be better classified as perishable products.

Mere payment of fixed carry by end users to merchants in a commercial trade market does not create a functional forward market that can be reflected in a forward futures market.⁵⁶ Australian wheat end users have generally paid a fixed carry charge per month to merchants within very decentralized and loosely established commercial trade markets since supply chain deregulation in 1989, but this has not developed into a liquid local forward futures market. Flexible carry determined by definable warehouse space that is influenced by supply and demand may be the key to forward markets for storable agricultural products.⁵⁷

Even when an agricultural forward futures market is effectively and functionally based on the underlying local commercial market requisites, its serious weakness is that its organized carry structure in the forward market

collapses when product shortages occur, and the forward months revert to speculative forecasting similar to that for nonstorable products. Product shortages can remove the forward market as a price discovery mechanism, with all focus on spot procurement for end users. There may be spot premiums to encourage spot sales, and varying price discounts in the forward months to discourage selling delays, however it is still an unstructured forward market that is likely to be weather-dependent, thus increasing basis volatility and making decision making very difficult for both speculators and hedgers.⁵⁸

Agricultural market inefficiency may occur because the futures market is too remote from the underlying commercial trade market, with signal transmission of information over time, distance, and through intermediaries being ineffectual. The trade-off between commercial and non-commercial interests to achieve some futures market liquidity and efficiency when there is isolation could result in market noise, rumours, misinformation, and attempts at manipulation.⁵⁹

Whilst agricultural futures market liquidity can depend on the efficient transmission of supply chain signals from the underlying physical commercial trade market to the futures market, there is still a need for critical minimum volume to be transacted. An efficient supply chain and forward market mechanism still may not attract the critical volume required for an effective futures market, especially when seasonal factors limit physical transactions.⁶⁰ Therefore, there is a need for regular commitment by speculators including fund managers to fill the liquidity void of futures markets, especially in the forward months.

Liquidity on a futures market is measured by the daily volume of contracts transacted, the number of opened contracts through Open Position or Open Interest, and market depth, which is the number of bids and offers at various price levels. A futures market without liquidity is ineffectual as a mechanism to offset physical price risk, because of the prevention of market entry or exit through novation and timing, or the incurrence of higher transaction costs through slippage.⁶¹ Liquidity needs to be balanced between hedgers and speculators to create futures clearing house effectiveness, otherwise a price distortion such as market squeeze can occur.⁶²

Increasing liquidity propagates even more liquidity in group frenzy,⁶³ which is how price trends are developed from the intensity of market sentiment. However, the greater the price trend strength, the less likely will arbitrageurs be able to make the spot and forward futures market adjustments required to reflect the underlying commercial realities. There is a delicate balance between the benefits and disadvantages of speculators in a futures market.

Arbitrageurs must be both strong and capable enough to maintain some association between the futures price and the underlying commercial trade realities, otherwise distortions will occur in the futures market which will increase basis risk and decrease the capacity for hedgers to effectively offset price risk.⁶⁴ Daily position limits are imposed by the futures exchange to keep speculative positions in relative balance to the hedgers, and to limit margin credit risk. A problem arises when some futures exchanges alter the rules regarding daily position limits and initial margins which can undermine trust in the system and the ability to hedge physical positions, and which seemingly favours large speculators.

Hedger activity and liquidity may decrease when futures contract specifications are dissimilar to physical product attributes, thus inducing basis risk. Such high basis risk that can discourage hedgers can sometimes attract speculators intent on price manipulation because of the disconnect with the physical market.⁶⁵ Some have argued that products need homogeneity for futures market standardization despite the success of heterogeneous contracts.⁶⁶

Futures market contracts may have wide contract specifications to increase deliverability and lessen the opportunity for a market squeeze, however it can result in price averaging across broad specifications that can affect basis risk in hedging, lessen market effectiveness, and increase speculative opportunities. Broadening the contract delivery specifications with a bareme of price premiums and discounts may favour only a select few market participants, given that less than five percent of deliverable futures contracts are delivered against. Alternatively, merely introducing additional futures contracts to minimize basis risk in hedging can cannibalize existing liquid futures contracts, as occurred with six different concurrent Australian wool futures contracts during 2000–2008.

It is highly unlikely that a successful futures market can be based on a commoditized product with many substitutes such as wheat for animal feed. Australia had a feed wheat futures market but it never achieved liquidity due to the lack of a concentrated and recognizable commercial trade market. Alternatively, a highly liquid US corn futures market that encompasses food, feed, energy, sweetener, starch, and alcohol submarkets is unlikely to allow the formation of a liquid US feed barley futures market,⁶⁷ or a US grain sorghum futures market.⁶⁸

Stockfeed manufacturers generally buy ingredients from the cheapest source at the time required using least-cost ration formulas. They might buy in the spot or the forward market, but each transaction is considered singular, opportunistic, and non-integrative. Such procurement behaviour

provides no foundation for a commercial trade market, which then can prevent the development of a liquid futures market.

Any factor limiting competition, contestability, and efficiency in supply chains can increase price distortions and limit the formation of forward and futures markets.⁶⁹ Distorted price signals can arise from monopoly, oligopoly, or government action either through directly controlling supply chain functions or through excessively large public institutional catering purchases. Price controls, subsidies, taxation, import or export controls and duties, buffer 'stabilization' schemes, quotas, statutory authorities, and large tender transactions can all distort price signals in the supply chain. Inadequate infrastructure can lead to supply chain distortions and affect commercial trade markets through congestion during intake, warehousing, out-take, transport, port, berthing, and shipping.

International usage of a foreign futures market is unlikely without some deregulation in currency and capital markets. Chinese futures exchanges have failed to achieve much market liquidity beyond their local commercial trade markets because of both currency and capital movement constraints.⁷⁰ Market liquidity can be linked to the removal of currency and capital flow restrictions, as was the case when US financial deregulation occurred.

Some government action is therefore required to ensure efficiency in the supply chain through enforcing competition, contestability, and contract law,⁷¹ as well as adequate monetary policies such as inflation control.⁷² However, there is a misconception that if mere financial deregulation and good monetary policy occurs, then this will somehow automatically flow onto agricultural supply chain efficiency and the formation of liquid futures markets. The two are usually quite incongruous. Resisting change can be very strong in food and fibre supply chains, even under deregulation.

Inadequate industry controls can lead to mistrust of futures markets.⁷³ The debacle over MF Global in 2011 when client money was purported to have been used for propriety trading undermined client confidence in the ability of the futures exchange industry to adequately safeguard their interests. Integrity is a vital component in the formation of liquid futures markets.⁷⁴

Futures contracts are guaranteed by daily margin cash settlement enforcement.⁷⁵ Specific regulations need to govern procedures for the enforcement of daily cash settlement through a futures market clearing house mechanism, otherwise credit risk guarantees cannot be enforced.⁷⁶ Without rules governing the delivery of the physical product and payment by the buyer, the contractual arrangement could collapse through opportunistic behaviour by one of the parties to the contract, depending on the direction of price.

Futures markets have an innate tendency to be rigid and resist change, which might be one reason why only three percent of futures contracts survive more than 50 years.⁷⁷ Traditional trading rooms were austere, but it was the supporting infrastructure and personnel that created an expensive clustering effect. Even under electronic trading, there needs to be clearing-houses supported by major banks, brokers, traders, price data scribes, settlement and surveillance personnel, accountants, auditors, administrative staff, and physical logistics personnel for delivery. Any change in the product, transport, or commercial trade market including weights, measures, method of quotations, and tick values may be resisted by the associated support and service industries.

As a general summary, futures markets cannot do the impossible, and just because there is no futures market or inadequate futures market liquidity, it may be due to the heterogeneity of product characteristics or the decentralized geographic dispersion of local commercial trade markets. The formation of agricultural futures markets historically has favoured homogeneous storable products which have critical minimum volume being transacted in a highly centralized locality with central warehouse facilities. Such restrictive prerequisites may explain why futures market success is rare. This situation perhaps should be best described as market inadequacy rather than market failure.

Problems with cash-settled futures contracts

Based on US futures contracts between 1921 and 1983, in excess of 180 agricultural futures contracts on 20 or more futures exchanges failed within ten years of their introduction.⁷⁸ There were only three twentieth century futures contracts that survived this time duration and all were both storable and deliverable. These were the high protein milling wheat contract on the Minneapolis Grain Exchange and oats on the Chicago Board of Trade, with both having low liquidity, as well as cotton on the New York Cotton Exchange. New York received cotton from southern USA for its local textile industries.

This failure rate suggests that the success surrounding the introduction of a futures market is not the panacea that is frequently purported, and that contract design and timing of introduction are very important success determinants. However, some futures exchanges resort to success probability, listing as many futures contracts as possible regardless of commercial trade market relevancy, in the probability that a small number of futures contracts will succeed.⁷⁹ Initial success may depend on nothing more than

having price volatility immediately after contract introduction,⁸⁰ but longer term sustainability generally depends on having a balance between the speculators and hedgers.

There may be an association between futures contract design, alignment to the local commercial trade market, relevancy to wider commercial interests, and liquidity.⁸¹ Introducing a cash-settled agricultural futures contract could be perceived as failure to facilitate physical delivery against the contract, an inability to establish forward market relevance, and an admittance that there were contract design problems. Success from the design of the contract becomes dependent on the flexibility that cash settlement offers to counter contract delivery manipulation.⁸²

If the forward market of a cash-settled futures contract is unstructured even in surplus markets, then it is unlikely that there is an adequate liquid physical spot market with centralized commercial trade and warehousing upon which forward prices can be based. Price fluctuations are then more likely to depend on very diverse supply and demand expectations based on extremely flawed long-term weather forecasts.

Whenever physical delivery cannot occur against a forward price, determining a price from the spot market for cash settlement becomes extremely difficult.⁸³ There are serious flaws in any statistical method of determining settlement price from prevailing spot market prices.⁸⁴ The clearing house usually resorts to price averaging over a time interval to avoid price distortions and manipulations.⁸⁵

Cash-settled futures contracts are commonly linked to perishable products that cannot have any commercial carry and warehouse forward market structure, and therefore there is no alignment of the forward futures market to any underlying forward commercial trade market.⁸⁶ Their failure rate is high and their hedging efficiency low because of high forward basis risk that is random and unstructured, with volatility that can be dependent on highly variable weather forecasts.

Cash-settled contracts are ideal for futures contracts based on physical indices that have no delivery component, with an ability to quickly arbitrage any basis differences between the physical index and futures contract index.⁸⁷ An index-based futures contract can have zero basis at cash-settled maturity because of perfect alignment with the physical index, which is usually not the case for agricultural futures contracts. However, it is the development of a relevant physical index that effectively reflects the relevant physical composites which can be a problem through basis risk, rather than any deficiency in the cash-settled index futures contract.

Issues with perishable products

Perishable product futures contracts may be cash-settled or deliverable. Even when perishable products such as mature age livestock are delivered against deliverable futures contracts, there can be many quality problems because the buyer has not seen the condition of animals beforehand, even though they meet futures contract delivery specifications.⁸⁸ However, the main problem of perishable product futures contracts is their lack of forward market structure because commercial trade end users perceive no forward value and therefore refuse to pay carry for storage.⁸⁹

Changing the delivery mode and product specifications within the contract design cannot overcome buyer rejection of the product due to supply chain risks.⁹⁰ Whilst meat can be frozen, buyers will not pay for refrigerated carry if they prefer freshly chilled beef. Mature animals and animal products are usually not suitable for prolonged storage periods.⁹¹ There is a major difference between processed products such as skimmed milk powder and cheese, which can be stored for many months, compared to fresh milk that cannot be stored more than a few days.

Perhaps there is a need to forward-sell perishable products before they are produced to manage budgeting and price risk, which can be an admirable goal in the food supply chain.⁹² The problem may be finding a forward buyer who is willing to purchase an uncertain product with specification risk, when there is no structured mechanism of establishing forward price other than spurious weather-dependent supply and demand forecasts. Reaching a forward consensus under such circumstances is possible but unlikely unless there have been previous supply chain relationships. Regardless of any such forward commercial agreements, liquid and relevant futures markets remain unlikely under such circumstances.⁹³

If unstructured forward prices do occur for perishable products, they are likely to be driven by speculative forecasts usually with unrealistic assumptions, and be prone to an imbalance between speculators and hedgers and possible price manipulation.⁹⁴ Forward futures prices for perishable products can only be determined from the spot physical price plus a forecasted supply and demand adjustment.⁹⁵ Under such circumstances, any forward price would be expected to be an inaccurate indicator or poor forecaster of forward spot prices, irrespective of whether there was a futures market or not.

Effective hedging for perishable products is largely confined to growth stages in animals. If a cattle lot feeder planned to buy feeder cattle in two months' time and sell the mature cattle in eight months' time after fattening

is finished, then the lot feeder could lock in both input and output prices today, thereby securing a fixed operating and profit margin.⁹⁶ For example, the purchase price today for feeder cattle in two months' time might be US \$1.00 per lb., whereas the selling price today for mature cattle in eight months' time might be US \$1.50 per lb. By locking in both prices today with the intention of taking delivery of the young cattle against the feeder cattle futures contract and then delivering them against the mature cattle futures contract, the lot feeder has locked in an operating margin of US \$0.50 per lb.

However, the theory of locking in an adequate margin rarely matches reality or the rhetoric.⁹⁷ On the assumption that there is only one regional weather pattern, the above example usually only works in a drought situation. The lack of pasture and high grain prices depresses feeder cattle prices to enable the lot feeder to buy young cattle at low prices in two months' time, with the assumption that high grain prices can be absorbed within the lot feed operations or else hedged. An expected shortage of mature cattle in eight months' time forces distant month prices to rise, thus enabling the lot feeder to lock in satisfactory higher prices and presumably an adequate margin.⁹⁸

However, the opposite can occur under good regional rainfall conditions. Good pasture and low grain prices could increase the demand for feeder cattle and drive up young cattle prices. The expected surplus of mature cattle in eight months' time could force distant month prices to fall, thus creating negative margins for the lot feeder. There are many problems for lot feeders in one regional weather system pattern, and there is often a need to hedge grain prices to take some variability out of the profit margin equation.⁹⁹

A similar situation occurred with the US hog industry before the removal of the pork belly futures contract.¹⁰⁰ Hog farmers could lock in margins by buying nearby pork belly futures and selling distant hog baconer futures, with deliverability against each futures contract. There were similarities with cattle regarding feed grain prices but the price impact caused by rainfall and pasture availability was removed for hogs. However, the potential for such profit margin opportunity remained problematical because low nearby month prices for pork bellies and high forward prices for hogs had to co-exist relatively simultaneously. Having locked in the porker purchase price, any delay in forward-selling the baconers was speculative.

An eastern Australian young cattle index was developed in 2001 that averaged 26 cattle auction prices straddling two completely opposite weather zones, with half in the northern zone with summer rain and winter

drought, and the other half in the southern zone with winter rain and summer drought. Large positive basis in one zone merely reflected the large negative basis in the other zone. The index merely averaged prices from the two zones, which then had little relevancy to young cattle prices in either zone. Basis risk may have been small between the index and the associated young cattle index futures, but there was huge basis risk between the physical young cattle and the index upon which the futures price was based.

One theory was that if the indexed futures price across 26 cattle auction centres reflected predominately drought conditions, then there was the opportunity to forward buy young cattle futures. Then there was the speculative hope that the index would change with good rainfall, thus driving up price because of the increased demand for young cattle. This problematical buy low on drought and sell high on a rainfall based strategy using index futures was highly speculative and dependent on seasonal changes within and between two weather pattern systems. Actual basis risk caused by major differences between the indexed futures price and local young cattle prices was as high as 50 percent of the indexed futures price. As such, the cash-settled young cattle futures contract failed, as did previous deliverable cattle futures contracts with dual weather pattern systems favouring delivery manipulation.¹⁰¹

12

ARBITRAGE AND SPREAD TRADES

Imperfections regularly occur in disparate supply chains and their related markets. Variations in uncertain supply and demand, inadequate and untimely transmission of information, and illiquidity can frequently cause temporal and spatial price discrepancies within and between supply chains and markets. The spread between prices can widen or narrow, and be accentuated by speculators seeking profit. It is the function of arbitrageurs to minimize these price discrepancies and ensure efficiency through a market-correcting factor. Inefficiencies and distortions can exist if these correcting factors do not occur regularly.

Arbitrage is defined as relatively riskless trading with simultaneous buying and selling, or selling and buying, to take advantage of price discrepancies either within the same market or between similar markets. It could occur between the physical market and the futures market. If the trading is not riskless and simultaneous, perhaps with a time gap between the buying and selling, then it is not strictly arbitrage but tending towards speculation.¹ There must be profitability otherwise arbitrage will not occur.

One of the primary roles of merchants is to arbitrage in supply chains and futures markets.² Any removal of merchants and their arbitraging role can turn price discrepancies into more permanent distortions that may cause signal dysfunction within and between supply chains and markets. Those supply chains and markets that have price distortions and supply chain dysfunction are highly likely to have inadequate merchant activity.

It is impossible to arbitrage the price differences between dissimilar products. The price differential between wheat and soybeans cannot be arbitrated because establishing opposite positions in two separate markets creates two different price risks, which therefore eliminates the possibility for arbitrage. Risk and arbitrage cannot be associated.

Arbitrage requires subsequent physical delivery, otherwise it will be merely a spread trade that speculates on the differences between two prices widening or narrowing. Without product delivery to remove basis, which in this case is the difference between two benchmarked prices, there could be risks that include basis, currency, and cash settlement.

Simple arbitrage might involve buying wheat in one locality at \$200 per tonne and simultaneously selling it into another locality at \$300 per tonne, and delivering the wheat at a transport cost of \$70 per tonne. On the assumption that the specifications of the wheat at \$200 per tonne exactly matched the specifications of the wheat at \$300 per tonne, then there could be an arbitrage profit of \$30 per tonne.

In contrast, if the wheat specifications at the two different localities were different, then price differentials relating to the same product may explain the price differences. No arbitrage is possible when it is based on price differentials of the same product. Price differentials are not the same as price discrepancies.

If the international raw sugar port selling price was US \$400 per tonne fob and the seemingly local physical purchase price was US \$350 per tonne fob, then raw sugar might theoretically be arbitrated for a profit of US \$50 per tonne. However, local prices might have been discounted due to the occurrence of sugar flocculation or moisture spoilage. Any local purchase at US \$350 per tonne could have been the discounted port price, and therefore there would be no arbitrage profit. Price differentials in this example explain the price differences, which results in no arbitrage potential. Therefore, price differentials must be separated from price discrepancies before any arbitrage potential can be identified.

There are two different arbitrage strategies that can occur between the physical market and the futures market for the same product. There is the Cash and Carry strategy and the Reverse Cash and Carry strategy.

Cash and Carry arbitrage

A Cash and Carry strategy occurs when the arbitrage merchant buys the local physical product at a low spot price, sells the forward futures contract at a high price, and then subsequently delivers the physical product against the

futures contract in the contract delivery period.³ It involves initial simultaneity in buying and selling transactions followed by a carry and delivery phase that removes risk. However, similar to all arbitrage strategies, there is a transaction cost.

Local physical prices can often be under the futures price in negative basis. An arbitrageur might perceive the negative basis and forward carry are too large and implement a Cash and Carry strategy, which could result in the basis and carry narrowing. There is a time element and carry involved as well as a perception of a price discrepancy between the physical and futures markets that can be traded for an arbitrage profit. Speculators are excluded because there is physical warehousing involved and delivery of the physical product, which confines the strategy to merchants in hedging, basis and carry trading.

The initial simultaneous buying the spot physical product and selling the forward futures contract is arbitrage despite the time difference, and it is the subsequent delivery of the physical product against the futures contract that completes the arbitrage. Therefore, a Cash and Carry strategy is riskless arbitrage provided that the initial price difference is greater than the carry and delivery costs, that the physical purchased product has the same specifications as required to be delivered against the futures contract, and that the futures clearing house accepts physical delivery against the contract.

Spot local soybean prices in early September might be US \$13 per bushel, whilst March US soybean futures price at Chicago may be US \$14 per bushel. Carry might be estimated at US \$0.04 per bushel per month, and transport at US \$0.50 per bushel. A merchant might buy spot local September soybeans, sell March futures contracts, carry the soybeans for six months, and then deliver them against the March futures contract in Chicago. Profit for the Cash and Carry strategy will be US \$1.00 per bushel less US \$0.24 per bushel carry less US \$0.50 per bushel delivery, equalling US \$0.26 per bushel less a time value of money factor.

Such Cash and Carry strategies might be perceived as profiteering from basis differences and distorting forward carry signals. However, Cash and Carry strategies provide one of the few methods to induce market efficiency by minimizing negative basis differences between the local physical and futures market prices. The perception in this case was either that the March futures price was too high relative to the local September spot price, or that the local September spot price was too low relative to a benchmark region as reflected through the March futures price. It can be argued that there is no distortion of carry in the forward market because merchants could have been required to carry the product regardless of any Cash and Carry strategy.

Reverse Cash and Carry arbitrage

A Reverse Cash and Carry strategy occurs when the arbitrage merchant sells the local physical product at a high spot price, buys the forward futures contract at a low price, and then subsequently accepts delivery of the physical product against the futures contract in the contract delivery period.⁴ It involves initial simultaneity in buying and selling transactions followed by taking delivery, which removes risk. There are transaction costs, but there is a carry cost savings in this strategy.

Local physical prices can often be above the futures price in positive basis and backwardation. An arbitrageur might perceive the positive basis and backwardation as too large and implement a Reverse Cash and Carry strategy, which could result in the basis narrowing and backwardation decreasing. There is a time element and a perception of a price discrepancy between the physical and futures markets that can be traded for an arbitrage profit, but there are major differences to a Cash and Carry strategy. Speculators are again excluded because the physical product needs to be sold and then received back against the futures contract which confines the strategy to merchants in physical hedging and basis trading.

The two assumptions in a Reverse Cash and Carry strategy are that the merchant initially has physical product in store and that there is a fixed forward selling schedule that requires the merchant to have inventory at a future date. If a merchant has no initial inventory, or does not require physical product at a future date, then no Reverse Cash and Carry strategy is possible.

Spot soybean prices in early September might be US \$15 per bushel whilst March US soybean futures prices at Chicago may be US \$14 per bushel. Carry might be estimated at US \$0.04 per bushel per month, and transport from receipt to store at US \$0.50 per bushel. A merchant with soybean stock might sell spot September soybeans, buy March futures contracts, and then accept delivery against the March futures contract in Chicago. Profit from the Reverse Cash and Carry strategy will be US \$1.00 per bushel plus a savings of US \$0.24 per bushel carry less US \$0.50 per bushel delivery, equalling US \$0.74 per bushel plus a cost of money saving. Also, freeing up warehouse space might enable the merchant to store a product that is more valuable than soybeans, which results in a higher return on warehouse space, yet with the knowledge that soybeans will be received against the futures contract in March.

Again, questions might arise as to whether such Reverse Cash and Carry strategies are profiteering from basis differences and distorting forward market signals. However, Reverse Cash and Carry strategies minimize positive

basis differences between the local physical and futures market prices. It also can be argued that there is no distortion of carry in the forward market because the new physical buyer would be required to carry the product if there was no immediate end usage. The strategy actually encourages spot physical sales when shortages occur, so there are some positive supply chain gains provided that there is sufficient product to take delivery in the future. There may be efficiency gains because the merchant now has additional warehouse capacity to store higher value products.

Economic role of arbitrage

Supply chain and market decisions that are based on human psychology and emotional behaviour can create market imperfections and price discrepancies that then require arbitrage to minimize them.⁵ Market imperfections and price discrepancies cannot be misconstrued as failure when the correcting factor is arbitrage.

Arbitrage has the capability to maintain supply chain and market efficiency,⁶ which assists in the transmission of spot and forward market signals that can convey market sentiment and supply chain behaviour quickly and transparently. The potential for arbitrage profit can be perceived as a positive contribution to supply chain and market efficiency. There may be no alternative to arbitrage because any attempt to micromanage the supply chain through intervention and price controls can worsen the problem through dysfunction and corruption.

Whilst efficiency can encourage market liquidity, market liquidity is not always synonymous with market efficiency. There can be high volume markets operating with large discrepancies with an imbalance between hedgers and speculators.⁷ Removing market discrepancies through arbitrage can sometimes make markets more relevant to hedgers and less of an attraction to speculators.

Arbitraging between two prices in different localities for the same or similar products is akin to a spatial spread that has distance separating the two prices. Provided that the dual transaction is relatively riskless through physical delivery, such simultaneity of buying, selling, and associated delivery is arbitrage. Trading such price discrepancies is the basis for much inter-regional and international trade.⁸

An international merchant could buy wheat from a Black Sea port for US \$300 per tonne fob and sell it simultaneously to Iraq at \$400 per tonne cif. Assuming the cost of sea freight, insurance, and administrative costs were US \$70 per tonne, then the arbitrage profit for the international merchant

might be US \$30 per tonne. There was no speculation because of the simultaneity of transactions with physical delivery, and profit margin risk was locked in so that a gain was theoretically made on the transaction, therefore it can be argued that the transaction was 'riskless', albeit with Black Sea warehousing, demurrage, shipping times, berthing space allocations, loading and other shipping issues, as well as Iraqi quarantine, unloading, customs, port issues, transport, and delivery timing. The greater the potential for risk, the less likely can the transaction be referred to as arbitrage, and the more likely it will be referred to as international trade.

The real problem with correctly identifying price discrepancies as the precursor to international trade and arbitrage is trade distortions that destroy accurate price signalling.⁹ Freer trade therefore may be associated with increased arbitrage opportunities because of less distortions and clearer signals.¹⁰ Arbitrage will be actively discouraged if what was thought to be an arbitrage opportunity actually ended with trading losses.

The question arises as to whether buying inputs or ingredients and simultaneously selling outputs or manufactured products can be considered arbitrage when product transformation occurs. Arbitrage usually applies to price discrepancies for the same product, but in this case the product has been transformed and there are product transformation risks such as manufacturing costs and meeting product specification. This transaction process of importing and re-exporting relatively simultaneously is very different to mere international trade.

Singapore is focused on arbitraging its geographic advantage between large countries of population concentration but within a small country that severely lacks natural resources, and supplements that with good macro- and microeconomic policies combined with competition and commercial law enforcement.¹¹ This arbitraging ability to both import and then re-export efficiently with value creation by manufacturers within supply chains in the same country but for a whole region is what generates much wealth for Singapore.

When risk is managed in long term supply agreements, the simultaneity of timing may expand into a continuous time frame. Singapore's ability to arbitrage differences between imports and re-exports has led to capital investment in domestic food manufacturing and logistics infrastructure, employment, and economic growth, whilst decreasing its dependence on final product imports.¹² The local clustering of industries and integration of suppliers has occurred in such a geographical food hub economic environment that it might be the case example of arbitrage benefits and supply chain risk management.

Limits of arbitrage

Arbitrage can be confined by the limits of product specification, which may commence with the selling side and be stipulated by the buyer, but which then needs to be simultaneously organized on the buying side and be settled with a seller. Specifications such as delivery timing, just-in-time procedures, and quality controls can be very difficult to exactly match in arbitrage. The arbitrage theory of simultaneously buying in one locality, selling in another and making riskless profit may not be simple in reality because of costs, impositions, or impracticalities.¹³ Even arranging delivery against a futures contract can be difficult.

There is always some secondary risk in arbitrage, apart from buyer credit risk. Transporting or shipping from the place of purchase to the place of sale involves delivery risk as well as timing risk. Arbitrage can involve a spot purchase and forward delivery, which necessitates warehousing and associated risks with storage costs, quality control, and loss of product specifications. Therefore, arbitrage cannot be devoid of secondary risk.

The seller could default on physical delivery or delivery terms to the arbitrageur, or fail to cash settle when delivery does not occur and prices rise. Alternatively, the buyer might default on the payment or force extra freight charges onto the arbitrageur in an attempt to lower the original price. What was originally considered riskless and profitable may end with high risks and losses.

Another limitation in determining the potential for arbitrage and international trade is correctly identifying a price discrepancy. Such a price discrepancy could be illusionary once all relevant factors are considered, such as freight costs and insurance, currency exchange rate slippage, taxes, economies of scale, the required quantities, specifications, quality maintenance, and human and logistical resources. What seems to be a price discrepancy and supply chain inefficiency may merely be a factor differential.

There is a large difference between price distortions and discrepancies. Trade distortions that are due to government intervention or monopoly control can cause price distortions that are relatively permanent and cannot be arbitrated. In contrast, price discrepancies can occur without trade distortions and be temporary. Efficient transmission of price signals is essential to enable arbitrage to remove price discrepancies.

In the attempt to arbitrage wheat between the Black Sea and Iraq, there may be export bans restricting shipment from Black Sea ports whilst imports into Iraq might be limited by import tender controls. International arbitrage is very dependent on freer trade between countries and can be prevented

by trade barriers. Alternatively, domestic arbitrage might be prevented by quarantine restrictions.

Because arbitrage requires product delivery, futures markets can remain distorted until contract delivery occurs in the arbitrage strategies such as Cash and Carry and Reverse Cash and Carry. In a strongly trending market with high liquidity, arbitrageurs may have no impact during the life of a futures contract, even during pauses in price momentum, because their real impact is confined only to the delivery period. Such limits on arbitrage correction may require market discrepancies in forward months to remain until each maturing contract reaches the delivery period. This can affect forward basis risk during the life of the futures contract and impact on the ability to manage forward price risk.

Some price discrepancies will always exist in supply chains and markets because the transaction cost to remove them is greater than the arbitrage profit.¹⁴ Arbitrage requires price discrepancies to be larger than the transaction costs before it will occur. Many product transactions involve freight, taxes, administration, insurance, bank fees, opportunity costs, commissions, and maybe currency exchange costs. Many of these costs are variable, which creates uncertainty in forward budgeting and planning.

The price discrepancy and profit margin potential may exist for an arbitrage opportunity, but implementation can be prevented by many logistical constraints such as shipping routes, available shipping and perhaps containers, and port constraints.¹⁵ Domestic transport constraints with roads and railways can limit access or be cost ineffective. Arbitrage then becomes a theoretical consideration confined by supply chain structure.¹⁶ Logistical constraints may lead to price distortions and an inability to arbitrage price discrepancies.

Governments can ban arbitrage because it takes advantage of government-controlled price differentials.¹⁷ Arbitrage and merchants remain the scourge of those that desire excessive government regulation, intervention, and trade protection. However, without arbitrage, supply chains and markets quickly become inefficient and poor conveyors of price signals that accurately reflect supply and demand conditions.

Spread trading

A spread is usually the price difference between any two dynamic variables, which can be traded speculatively to widen or narrow. However, what may be carry in the forward months to a merchant or end user, may be a temporal price spread between the months for a speculator. Alternatively, what

may be grade spread to a merchant may be a spatial or inter-commodity spread for a speculator.

Spread trading is similar to arbitrage in that it involves establishing simultaneous buy and sell positions or sell and buy positions. However, there is no physical product exchanged in spread trading, thereby introducing the risk of speculative losses.¹⁸ Therefore, spread trading cannot be considered as arbitrage because of this speculative risk.

The ease of entry and exit in futures markets facilitates the trading of spreads because there is no physical product exchanged. There are a number of different types of spreads that can be traded on a futures market.

Commodity spreads. Trading an inter-commodity spread to narrow between wheat and corn might involve selling higher-priced wheat futures and buying lower-priced corn futures, but with no delivery against contracts.¹⁹ The risk is that the spread may widen instead of narrowing, which could result in losses on each futures contract in that wheat could rise and corn could fall, or the losses on one could outweigh the gains of the other. However, if wheat futures fell by US \$1.00 per bushel, and corn futures rose by US \$0.50 per bushel, spread profit would be US \$1.50 per bushel less two brokerage fees.

Alternatively, trading the spread to widen between wheat and corn might involve buying lower-priced wheat futures and selling higher-priced corn futures. The risk is that the spread could narrow. If wheat futures fell by US \$0.50 per bushel, and corn futures rose by US \$0.50 per bushel, spread losses would be US \$1.00 per bushel plus two brokerage fees.

Spread indices. The futures exchange can introduce a cash-settled index contract on the spread between wheat and corn to reduce transaction costs and to generate speculative interest. Spread trading on an index contract reduces transaction costs to one set of brokerage fees and margin requirements. The contract must be cash-settled because of the impossibility of delivering against an index. A spread trader would buy the spread index if the spread was expected to widen, or sell the spread index if the spread was expected to narrow.

Time spreads. These are also known as calendar or intra-commodity spreads, and they involve establishing buy and sell positions on different months of the same futures contract. Time spreads are akin to speculatively trading carry or backwardation in forward months.

A time spread with an expectation that prices will narrow between July and December wheat might involve selling higher-priced July wheat futures and buying lower-priced December wheat futures, but with no delivery against contracts. The risk is that the price spread may widen instead of narrowing, which could result in losses on each futures contract or the losses on one outweighing the gains of the other. If July wheat was sold at US \$8 per bushel, and December wheat was bought at US \$8.50 per bushel, the time spread is US \$0.50 per bushel in a carry forward market. Subsequently, if July wheat rose to US \$9 per bushel, and December wheat fell to US \$8 per bushel in a backwardation forward market, the loss is US \$1.50 per bushel. This negative spread involving selling the near month and buying the distant month is trading either carry increasing or backwardation decreasing.

Alternatively, trading the price spread to widen between July and December wheat might involve buying lower-priced July wheat futures and selling higher-priced December futures. The risk is that the spread could narrow. If July wheat was bought at US \$8 per bushel, and December wheat was sold at US \$8.50 per bushel, and subsequently July wheat rose to US \$9 per bushel, and December wheat fell to US \$8 per bushel, the gain is US \$1.50 per bushel. This positive spread involving buying the near month and selling the distant month is trading either carry decreasing or backwardation increasing.

Product grade spread. Spreads can exist between two products based on grade differences, such as protein percentages. Chicago has nine percent protein soft wheat futures contract whereas Kansas has an 11 percent protein hard wheat futures contract. Price differentials between soft and hard wheat should reflect the added protein value to flour millers. This grade spread for wheat provides important signals to farmers regarding discretionary fertilizer application decisions and can affect overall demand for nitrogen-based fertilizer.

Spread traders can speculate on relative price movement between soft and hard wheat. Chicago soft wheat could be bought at US \$7.00 per bushel and Kansas wheat could be sold at US \$7.50 per bushel if the expectation was that the grade spread would narrow. This situation might occur if the Chicago region did not receive rainfall whereas the Kansas region received adequate rainfall. Alternatively, soft wheat exports might be in higher demand than for hard wheat. Risk occurs if the spread subsequently widened, either because of rainfall in Chicago or export demand for hard

wheat increasing. If Chicago wheat fell to US \$6.80 per bushel while Kansas wheat rose to US \$7.80 per bushel, then there would be a spread loss of US \$0.50 per bushel.

Alternatively, Chicago soft wheat could be sold at US \$7.00 per bushel and Kansas wheat could be bought at US \$7.50 per bushel in a grade spread if the expectation was that the spread would widen. This situation might occur if the Chicago region received adequate rainfall whereas the Kansas region received little rainfall. Alternatively, soft wheat exports might be in less demand than for hard wheat. The risk is if the spread subsequently narrowed, either because of export demand for soft wheat increasing or rainfall in Kansas. However, if Chicago wheat fell to US \$6.80 per bushel while Kansas wheat rose to US \$7.80 per bushel, then the spread widened and there would be a spread gain of US \$0.50 per bushel.

Intra-commodity spread for a merchant

A merchant could undertake a time spread strategy with different months on a futures exchange and then use the sell and buy futures to trade the physical product.²⁰ Because it involves simultaneous riskless buying and selling deliverable futures contracts, it must be considered arbitrage, although there are major differences with Cash and Carry and Reverse Cash and Carry strategies. Again the strategy is confined to merchants because of the warehouse carry and delivery requirements.

There are assumptions that the merchant initially has physical product in store and that there is a fixed forward selling schedule that requires the merchant to have inventory at a future date. If a merchant has no initial inventory, or does not require physical product at a future date, then no such spread strategy is possible.

In June, September wheat futures prices at Chicago might be US \$8 per bushel, while December wheat futures prices might be US \$7 per bushel. The cost of carry is US \$0.04 per bushel per month, and delivery transport is US \$0.50 per bushel. The merchant sells September futures and buys December futures in a negative time spread in a backwardation inverse forward market. Regardless of subsequent futures price movement, the merchant could deliver physical product against the sell September contract and receive US \$8 per bushel, and then take delivery against the buy December futures contract and pay US \$7 per bushel. Despite different delivery dates and the two physical transactions of delivering and taking delivery, it is the simultaneity of the initial spread in a riskless transaction plus the delivery component that deems it to be arbitrage.

There is a cost saving of US \$0.12 per bushel involved with three months carry, which may free up warehouse space for products more valuable than wheat and which may result in a higher return on warehouse space. The problem with this strategy is the double logistical cost of transport, which negates any arbitrage gain from the price differential. However, the cost saving of US \$0.12 per bushel carry remains, plus a small gain in the cost of money for three months, thus making the strategy profitable. The early cash flow in September could have additional business operational benefits.

Problems with spread distortions

Spread trading may be considered rather innocuous but it can cause large distortions in forward markets, particularly in time spreads and those inter-commodity spreads involving forward futures months. Spread trade distortions can be removed at contract delivery time, but there is damage caused to forward price signals relative to the spot price up to the time of delivery. If the spread is rolled over when contract maturity approaches, then the forward price distortions assume a more permanent characteristic.

Spread traders have argued that they are attempting to remove suspected price discrepancies. This assumes that price discrepancies can be readily identified by futures market speculators and that there is sufficient liquidity in the futures market. Corn may have some relevancy to feed wheat despite the animal feed corn market only representing approximately 10–20 percent of the total US corn market. However, any estimations of whether there should be corn: wheat parity or premiums or discounts between the two products is mere speculation.

Buying corn and selling wheat using the same month contracts might be over-valuing corn and under-valuing wheat. Speculating on such a spread might have some fundamental justification if there was a lack of rainfall in the US Corn Belt and adequate rainfall in the US winter wheat belt. Driving markets based on rainfall is problematic at best, but when used to change price relativities between two products with multiples end usages, it may be unnecessarily distorting for food buyers and manufacturers.

Time spread traders speculate on carry to increase or decrease in the forward market for the same product, or speculate on backwardation increasing or decreasing. Rather than leading to expected market correction, such speculative spreads can easily result in worsening forward price distortions, which then transmit incorrect signals to farmers, merchants, and end users.

Trading carry or backwardation to increase or decrease requires intricate knowledge on whether warehouse space is increasing or decreasing, how

much physical product has been purchased by end users, and how much contango has been paid to merchants by end users to defer delivery to a later date. Any forecasting of forward market changes based on new crop weather considerations and not on intimate physical supply chain knowledge within very private commercial transactions can be highly speculative.

To ban spread trading for reasons of market efficiency is to deny the rights of speculators to trade opportunistically. Speculators do create liquidity, and liquidity is also an essential component of market efficiency, particularly in the forward months. Therefore, spread trading distortions may have to be considered a trade-off for market liquidity. However, the ability of forward markets to correctly provide signals to supply chain decision makers is thereby reduced.

It can be argued that any forward market is only an approximation of the physical reality because of the private nature of physical forward transactions that also include forward warehousing. Relating carry to warehouse space in a forward market that is associated with a dynamic spot market and a fragmented warehouse market is problematical at best, and more likely to be theoretically calculated.

The real problem is that any theoretically-based forward market price spread strategy affects the ability to manage price risk and it is an important factor in basis risk variability that determines hedge effectiveness. However, much depends on market position, and what may be disadvantageous to one market position may be advantageous to the other market position.

CONCLUSION

Despite the uncertainty of food and fibre production, the persistence and sometimes worsening positive global price skewness is evidence of general surplus agricultural product for most of the time. Abundance of product may be essential for the development of forward market structure through the carry charge provision, but only if there is a strong underlying commercial trade market with forward integration.

If the majority of local end users use the spot market for just-in-time procurement because of product abundance, the development of commercial trade markets and forward integration are unlikely to occur. This hinders the development of liquid futures markets, which then has a negative spillover effect on the ability and willingness to hedge price risk.

The lack of regular high pricing opportunities as reflected in positive price skewness and an inability to effectively hedge price because of market risks such as liquidity, basis, and perhaps currency, are contributing to increasing poverty amongst global farmers at a time of rapidly increasing costs. This is occurring at a time when tax-payers and trade reformers are questioning production subsidies and income support that further increase burgeoning government fiscal debt.

Farmers are unlikely to avail themselves of forward contracts or hedging before harvest if there is high production uncertainty and hedging risks. Preharvest usage of price risk management practices is likely to be confined to irrigated farmers or those that are assured of production for most of the time. If dry-land farmers venture into preharvest hedging using futures,

options, or over-the-counter products, then it is likely to be opportunistic with relatively low hedge ratios.

Those farmers who sell at or near harvest have the cash flow advantage to seek subsequent upside price enhancement through a buy call options strategy. The ability for farmers to enhance price postharvest need not be associated with deferment of a physical sale. In contrast, those farmers who defer sales postharvest through private hoarding or group pooling strategies are unlikely to desire any price risk management, either because of the lack of cash flow to fund the strategy or because it can undermine the objective of maximizing price.

Instead of suppressing agricultural prices and worsening the positive price skewness, there is a need to allow price volatility to occur so as to enable farmers to become financially viable without the use of subsidies. Farmers could then avail themselves of high pricing and short hedging opportunities, while end users could avail themselves of low pricing and long hedging opportunities. The outcome could be greater forward liquidity in commercial trade markets which would then support liquid and more relevant futures markets that could encourage greater usage of price risk management practices and less physical and futures speculation. Less hoarding and pooling combined with more supply chain integration would be expected to lead to greatly improved and more effective global food and fibre supply chains.

The research question that arises is whether the agricultural price distribution during the second half of the nineteenth century is any different to the positive skewness today. If agricultural price distribution during the second half of the nineteenth century had a relatively equal propensity for prices to rise and to fall, then this could explain why there was much commercial trade activity between merchants and end users, which then led to the formation of many agricultural futures markets and assisted the adoption of price risk management practices.

However, if price distribution became increasingly more positively skewed during the twentieth century for any number of reasons, including subtle price suppression or direct government intervention, then this could explain why there was a reluctance to establish commercial trade activity between merchants and end users, which then undermined the effectiveness of many agricultural futures markets and prevented the adoption of many price risk management practices. The resultant increasing farmer poverty and nonintegration in supply chains can explain the foundation for global food insecurity in the twenty-first century.

Unless prices are allowed to fluctuate and assist farmers to become financially viable and not be dependent on handouts from debt-ridden governments, food insecurity will continue to fester in the minds of consumers and politicians. Short-term pain through supply chain reforms may lead to long-term gain and improved security.

Another research question is determining the point beyond which futures markets become highly speculative, corrupted, and manipulative, which is then used as an example of market failure and justification for government intervention. If corruption is occurring in markets, it is highly probable that government intervention could entrench corruption. Intervention will not solve corruption *per se*. Despite the many benefits that would be gained from a liquid and effective forward pulse market in India, it could be that no market is better than a corrupted market because of the damage it can cause to the freer market image in general, and to price risk management in particular. Adequate reforms are unlikely if a corrupted futures market is epitomized as an example of market failure.

Structural and administrative reform must commence with government, as was the case in Singapore, which has achieved a remarkably successful model for food supply chain integration and risk management as part of its regional import and re-export food manufacturing and distribution hub.

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NOTES

Chapter 1

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Chapter 12

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GLOSSARY

Act of god. Nonhuman influence beyond the control of either the buyer or seller which prevents contractual obligations being fulfilled. It contrasts with force majeure.

Against Actuals or Exchange-for-Physicals. The exchange of futures contracts when a physical transaction occurs. The futures broker and clearing house need to be notified.

Agents. These act on behalf of either a particular buyer or seller for a fee or commission, and may handle, store, and distribute the product, but who do not take physical title or ownership of the product.

Arbitrage. Riskless simultaneous buying and selling, or selling and buying, of a product to take advantage of price discrepancies either within the same physical market or between physical and futures markets (cash and carry). Arbitrage requires physical delivery.

Auctions. Public places where an auctioneer usually facilitates spot physical bidding (US or Dutch) or sealed bidding (Japan), and are characterized by passive sellers whose only participation is to set a reserve price.

Back-to-back contracts. These occur when a merchant has a buy commitment offset with a sell commitment. Price risk exposure must be offset.

Backwardation. The forward month prices are at a discount to the spot month price. As a traditional merchant term, it referred to the discount or percentage that a seller had to accept for delaying the delivery of physical inventory to a buyer. It refers to a shortage forward market whereby either the end user pays a premium for spot delivery which is above the price paid for future deliveries, or else pays a discount for forward deliveries.

Balance of crop contracts. These are offered by buyers wanting to purchase the remainder of a particular grower's crop which has not been sold forward at a fixed price.

Bareme. It is a publicly listed price schedule. There could be a list of prices for a range of products, or it could refer to a premium and discount schedule for the one product type.

Basis. Traditionally it referred to how price is based from a benchmark price. If the benchmark price is a futures market price, basis can refer to the difference between the local price and the futures price. Spot basis is the difference between the spot local price and the spot futures price, whereas forward basis is the difference between the local forward price and the forward futures price, unless otherwise stated or agreed upon.

Basis risk. The risk of adverse movement between local prices and a benchmark price over time. In futures and options hedging, basis risk depends on parallelism, and is extremely important in determining the hedge (offsetting) effectiveness.

Bear markets. Markets in which prices are in a downward trend.

Bid. Active buying at a particular price.

Brokers. These link buyers to sellers anonymously, usually for a fixed brokerage fee.

Bull markets. Markets in which prices are in an upward trend.

Buy call options. The buyer of call options is given the right but not the obligation to take up the underlying buy futures contracts, whenever prices rise.

Buy put options. The buyer of put options is given the right but not the obligation to take up the underlying sell futures contracts, whenever prices fall.

Call options. The buyer of call options is given the right but not the obligation to take up the underlying buy futures contracts, whenever prices rise.

Card price. A publicly listed price for unsold delivered product upon arrival. It may also be referred to as a to-arrive price, ex-silo price, delivered price, or ex-store price.

Carry. This refers to the reimbursement within commercial trade markets by the end-user to a merchant on a monthly basis for the cost of storing the specified product over a period of time. It can measure time value, and does not refer to creating place value through transport.

Cash and carry. An arbitrage strategy whereby the physical product is purchased at the low price, with simultaneous sell futures established at the high price, and then physical delivery occurs against the futures contract in the delivery period.

Cash market. A physical market where the actual product is delivered and payment is made. It does not distinguish between spot and forward transactions.

cif. Cost (or commission) insurance and freight to destination port.

Circle of trades. A series of forward contracts between intermediaries in the supply chain which have the same product origination.

Clearing house. The authority in a futures market which is made responsible for novation, daily margin settlement, initial margins, and position limits.

Commercial trade market. A forward contractual arrangement in a surplus supply chain between a merchant and end user, which specifies the product to be delivered, receival times, localities, and price and contango (including carry) paid by the end user to the merchant. They can disintegrate whenever product shortages occur.

Commingling. Undifferentiated product mix which results in commoditization.

Commodity. Undifferentiated product.

Commodity exchange. A private buying and selling centre where both active buyers and sellers (or their brokers) transact for a designated product without an auctioneer. There can be both spot and forward month facilities.

Commodity pool. Traditionally, it was farmer-based unsold commodity that was usually commingled with the specific aim of delaying sales to enhance price after delivery through price speculation. There can be privately operated pools under deregulation.

Commodity swaps. Cash settled forward pricing products that are usually bundled with currency, which may be offered by banks or commodity exchanges.

Consignment. The delivery of unsold commodity to an agent in the expectation that it will be sold.

Contango. As a traditional merchant term, it referred to the charge or percentage paid by the end user to an accumulating merchant to delay the delivery of physical inventory whenever surpluses occurred, to enable just-in-time deliveries to occur. The contango forward month prices are at a premium to the spot month price, which reflects carry and results in the forward month prices being stepped upwards.

Countertrade. International trade whereby the buyer makes payment or transfer that is not in the currency or method preferred by the seller. Barter may be one form of countertrade.

Credit risk. The risk of nonpayment by another party and occurs whenever there is insufficient asset security to cover the risk of payment default.

Default. This occurs whenever either party to a contract cannot fulfill contractual obligations at settlement. If physical delivery cannot occur by the seller, then the contract is either cash-settled or an agreed upon alternate physical exchange occurs. If cash payment cannot be made by the buyer, then bankruptcy proceedings are usually implemented by the seller.

Delta. The change in the options price given a change in the underlying futures price.

Delta hedging. The adjustment based on Delta movement in the number of buy options contracts, given some predetermined hedge ratio requirement.

Differentials. Price differences due to different product specifications.

Economies of scale. Unit cost decreases with increased quantity, but only up to a critical point after which diseconomies of scale occur through breakdowns.

Elasticity of demand. This measures the responsiveness of demand (by an end user or consumer) to a change in price. The greater the responsiveness, the higher the elasticity.

Elasticity of supply. This measures the responsiveness of supply (by a farmer or speculative merchant) to a change in price. The greater the responsiveness, the higher the elasticity.

Exchange-for-Physicals (EFP) or Against Actuals. The exchange of futures contracts when a physical transaction occurs. The futures broker and clearing house need to be notified.

Exercise price. The price predetermined by agreement between the buyer and seller of either puts or calls, at which an options contract can be exercised by the buyer. It is also known as the strike price.

Fair price. A price based on actual product specification differentials. It is important in arbitrage.

Flat price. A price that includes all of its component parts, such as futures price, local basis, and perhaps currency exchange.

fob. Free-on-board, fully stowed on-board ship at origin port.

Force majeure. Third party hindrance that prevents contractual obligations being fulfilled.

Forward contracts. Contractual agreements to transact between a buyer and seller at some future point in time at a price which is usually set when the contract is established. They may be specified as deliverable or cash-settled.

Forward pricing. This refers either to a forward contract price or to a hedged price.

Forward selling. This necessitates a forward contractual agreement between a seller and buyer to transact a certain quantity and quality of physical commodity at a certain future time. Price is established at some agreed upon time.

Futures market. A central exchange where standardized forward contracts are traded.

Hedge. The process of offsetting an initial long or short market position with an equal but opposite market position in an approximate parallel market.

Hedge ratio. The percentage of total quantity to be hedged; it is expressed by the quantity to be hedged divided by the total quantity.

Hedged-to-arrive contract. A forward contract between a farmer and merchant, which is hedged with futures (and currency if required), but which leaves basis flexible and at the discretion of the farmer until delivery occurs.

Hoarding. The opportunistic withholding of the supply of unsold product with no commercial trade agreement, with the aim of speculating on upside price movement.

Initial margin. The initial margin is a performance bond in a client's futures trading account which is usually sufficient to cover the limit associated with a maximum one day price movement trading loss.

JIT. Just-in-time inventory delivery, usually by a merchant to an end user.

Lien. Legal entitlement over another person's property or retained possession until a debt has been repaid.

Liquidity. This can refer to daily volume being transacted, the number of open positions, or the market depth.

Long position. A market position that has downside risk. In the physical market, it refers to anyone who either holds or expects to hold physical commodity with no contract to sell or price commitment. In the futures market, it refers to the buyer of a futures contract.

Lot selling. It refers to the offering of a specific quantity of a standard grade of a commodity.

Margin call or Maintenance margin. The amount required by the clearing house for a client to top up a futures trading account usually within 24 hours, otherwise the position can be closed at the discretion of the futures broker.

Marked-to-market. Daily account valuation based on official daily market settlement prices.

Market depth. The number of bids and offers within a range of prices above and below the current market price.

Merchant. A supply chain intermediary who takes ownership title over the product, is characterized by buying and selling functions, and is a risk-taker except for price. Any merchant who undertakes price risk becomes a physical speculator.

Novation. This refers to the initial linking of a buyer with a seller by a clearing house, then delinking with the clearing house taking an opposite position to each party. When one of the original parties wants to exit there is a relinking with another party who also wishes to exit. It assists market liquidity.

Offer. Traditionally, it is the bringing of a product to sell at a price. However, both sellers and buyers can passively offer a price.

Open interest. In a futures market, this refers to the number of futures contracts that are open for any particular contract month. Also known as Open Position.

Open outcry. Verbal active buying and selling in trading pits.

Open position. This refers to the number of futures contracts that are open for any particular contract month. Also known as Open Interest.

Options on futures. Options on a futures contract gives the right to the options buyer, but not the obligation, to take up the underlying futures contract.

Over-the-counter product (OTC). This refers to a cash settled bundled pricing product that may involve futures (swaps) or options (floors, ceilings, collars, and participating forwards), as well as currency.

Pool price. A collective price averaged through sales from a comingled commodity pool over a fixed selling period.

Pooling. Commingling of unsold commodity by a collective of farmers, generally with the aim of averaging price from a spread of sales over a certain time period.

Position. Market position is expressed as being long, short, or neutral.

Position risk. Upside or downside risk associated with establishing a short or long market position.

Premium. In an options market, it is the price paid by the buyer to the seller of the option.

Price discovery. The establishment of price in deregulated markets.

Price risk. This results from unfavourable movements in price occurring between when the initial position is established and when it is ended.

Put-call parity. The premiums of at-the-money put and call options should be approximately equal. Any premium differences may be explained by transaction costs.

Put options. The buyer of put options is given the right but not the obligation to take up the underlying sell futures contracts, whenever prices fall.

Realized price. Final net price after a transaction has occurred.

Reverse cash and carry. This is an arbitrage strategy with a fixed forward selling schedule, whereby the physical product is sold at the high price, with simultaneous buy futures established at the low price at some future time, and then physical delivery is taken against the distant futures contract in the delivery period.

Risk spreading. This usually refers to strategies that spread risk over many business enterprises, however it does not manage risk. It may be synonymous with risk diversification.

Risk transfer. A strategy that transfers risk to another party.

Roll over. This occurs when a spot month position is closed and then the same position is re-established in a distant month. It refers to the rolling over of futures market positions, and may be synonymous with resetting.

Roundturning. The notification to the broker to exit existing futures contracts and not to establish new positions.

Scale down (buying). Buying at regular intervals in a falling market.

Scale up (selling). Selling at regular intervals in a rising market.

Settlement price. This refers either to the last transaction price of the day, or it can refer to the mid-point between the last realistic bid and offer of the day. This price determines daily margin variations and cash settlement, as well as open position valuation.

Short position. Any market position that has upside risk. In the physical market, it refers to anyone who sells without sufficient inventory and without any contract to buy or price commitment. In the futures market, it refers to the seller of a futures contract.

Short selling. Selling a product or asset not presently owned or held, but with the intention of buying it back cheaper at some later date.

Slippage. Unfavourable market movement can occur when entering or exiting a market position. It can be measured by the spread between the bid and offer prices.

Speculation. Any open market position that is not offset by an equal and opposite position.

Spot market. A market in which immediate physical transactions and delivery are occurring. Ideally, immediate cash payment should also be occurring.

Spot transaction. An immediate transaction with some urgency at the current spot price when the seller is willing to sell and able to deliver, and when the buyer is willing to accept and able to pay.

Squeeze. A market squeeze can occur when the willingness to transact is not matched by the other party. If buyers are desperate to buy and the sellers are not, prices can rise quickly. Alternatively, if sellers are desperate to sell and the buyers are not, prices can fall quickly.

Strike price. The price predetermined by agreement between the buyer and seller of either puts or calls, at which an options contract can be exercised by the buyer. It is also known as the exercise price.

Theta. A measurement of time decay for premiums in options contracts.

Time decay. The fall in the options price as the options expiry date approaches. It is measured by Theta.

To-Arrive price. A listed price for unsold delivered product upon arrival. It may also be referred to as a card price, ex-silo price, delivered price, or ex-store price.

Trader. Anyone who buys or sells product, either in the physical or futures market. The term includes both hedgers and speculators, as well as farmers and end users.

US Dollar Index. An index of the US dollar against a basket of currencies of the major trading countries that undertake trade or currency exchange with the USA.

Vega. This measures the sensitivity of options price to changes in futures price volatility.

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INDEX

- act of god 24
- account valuations 73–8
- adoption factors 52, 53
- Against Actuals 84, 85
- anticipatory hedge 83
- arbitrage 3, 12, 220, 221, 224, 228–40
- Argentina 18
- at-the-money (ATM) 106
- Australia 18, 32–4, 38, 45, 48, 52, 129, 219, 221, 226, 227
- back-adjusted data 169
- backwardation 37–41, 57, 82, 94, 98, 99, 148, 149, 151, 163–4, 179, 214, 216, 231, 236, 237, 239
- bar charts 169
- barter 9, 12, 37, 42
- basis 42–3, 50–57, 85, 193, 194, 216, 224, 230–2; basis risk 55–7, 80–101, 161–7, 215, 216, 221, 224, 227, 240; basis trading 84, 95–8, 230–2
- bid 8, 10, 20, 29; bid: offer spread 81, 101, 108, 133, 142, 152
- Brazil 32, 200, 201, 205–7
- brokerage fee 76–8
- buffer stocks 13, 45, 172, 173, 222
- bull-whip effect 21
- bundled products 128–44
- bunker storage 33, 174, 176, 177, 182
- buy: futures 76; in arrangements 69, 70
- buy calls 103–5; options hedge 115–17
- buyer strategies 90–93, 115–17, 128–44, 157–67
- buy puts 103–5; options hedge 117–22
- calendar spread 236
- call options 102–27
- Canada 18, 26, 33, 48, 49, 67, 193, 208–11
- candlestick charts 169
- caps 137, 138
- carry 28–43, 57, 94, 98, 99, 148, 151, 177, 179, 214–19, 229–32, 236–9
- cash: and carry strategy 229, 230, 235; settlement 3, 12, 20, 45, 53, 69, 223, 224; cash settled futures 223–4
- catastrophe insurance 123, 124
- cattle: futures 226, 227; hedging 225–7
- ceilings 137, 138
- centralization 10, 27–33, 46, 55, 56, 61, 198, 200, 219, 224
- certainty 9, 10, 11, 14, 18, 19, 22, 23, 36, 37, 48–50
- charting analysis 168–9
- Chicago 26–34, 43, 53, 223
- China 38, 168, 201, 222

- circle of trades 19, 22, 75
- clearing house 30, 55, 61, 68, 78, 79, 102–4, 107, 108, 128–32, 201
- closing settlement price 61, 76, 77
- cluster industries 22, 27, 30–3, 71, 179, 184, 218, 223, 233
- coffee 32, 43, 218, 219
- collars 122, 123, 138–40, 154–66
- commercial trade markets 1, 2, 7, 10, 18–21, 24, 28–41, 53, 55, 233, 241
- commingling 33, 47, 61, 63, 70, 153, 181–5, 190
- commodity: pooling 181–92; poverty trap 171, 188, 213; spreads 236, 238, 239
- competition 10, 25, 31, 35, 152, 186, 189, 197, 198, 222, 233
- competitiveness 5–8, 18, 51, 196, 197
- consumers 5, 6, 9, 10, 20, 22, 31, 57
- contango 34–41, 82, 84, 94, 136, 148, 151, 163–4, 176, 187, 216, 240
- continuous data 169
- contracts 3, 8, 18–24, 28, 38, 53–55, 58–79; default 2, 6, 7, 16, 20, 38, 47, 50, 53–55, 66–75; law 22–5, 53, 54, 222; risk 53–55; transferability 54, 55; valuation 73–8
- contrary behaviour 9, 94, 178
- cooperatives 181–92
- corn 15–18, 27–29, 43, 48, 219, 239
- corruption 9, 10, 25, 43, 45, 243
- cost of production 10, 14, 51, 72
- cotton 51, 149, 177, 180, 215, 223
- countertrade 9, 12, 42, 194
- credit risk 61, 66–9, 72–8
- cropping year 34–7, 39–41, 43
- cross-hedging 84
- currency 3, 8, 25, 34, 42, 43, 50, 51, 55, 57, 85, 141, 167, 193–211, 222; collars 207–11; fixity 198, 199; flexibility 197, 198; forward markets 199, 200, 222; futures 205–7; hedging 84, 132, 141, 202–11; options 207–11; risk 3, 42, 43, 50, 53, 57, 61, 66, 100, 141, 164–7, 193, 194, 200, 201, 234; risk management 202–11
- cycles 168
- daily margin settlement 60, 61, 222
- daily position limits 221
- dairy products 225
- decentralization 10, 32, 33, 46, 197, 219, 223
- decision making 1, 8–16, 20, 25, 29, 30, 42–57, 170–92
- default 2, 6, 7, 16, 20, 38, 47, 50, 53–5, 66–75; settlement 68–71
- deliverability 216, 221
- delivery manipulation 227
- Delta 126; hedging 126, 127; -neutral 126
- demand 8–13, 16, 21, 32, 34, 40–42, 49, 57
- deregulation 1, 3, 26, 63, 128, 129, 182, 197, 218, 219, 222
- discretionary accounts 86
- distortions *see* price distortions
- Dodd Frank Act 2010 130
- dual year delivery 70
- efficiency 2, 3, 6, 9, 25, 31, 32, 43, 81, 100, 106, 130, 152, 153, 182, 185, 188, 189, 190, 199, 200, 212, 214, 217, 220, 222, 224, 228, 230, 232, 234, 240
- elasticity 6, 13
- end users 7–22, 90–3, 115–17
- end user strategies 90–3, 115–17, 128–44, 157–68
- Europe 18, 27, 52; Euro 194, 195, 199, 202–5
- exchange for physical 84, 85
- exchange rate 5, 8, 42, 43, 57, 193–201
- exercise price 106–27
- export bans 16, 38, 234
- extrinsic value 109–27
- farmer: strategies 87–90, 117–22, 145–53, 165–8, 170–92; support programs 2, 15, 31, 45, 47, 49, 52, 241
- flat price 42, 55, 85, 161, 162
- floors 137, 138, 154–66
- food: aid 10; processors 6–8
- force majeure 24
- forward: basis 42–3; contracts 3, 8, 1824, 38, 53–5, 60, 61, 154–67; currency rates 199, 200; exchange

- contracts 202–5; markets 1, 2, 3, 6, 8, 9, 22, 26–43, 218; pricing 14, 27, 37, 42
- freer trade 20, 27, 172, 175, 197, 233, 234, 243
- futures: broker 85, 86; contracts 28, 54, 55, 60, 61, 68, 80–101; first contract 154; hedging 80–101, 154–66; markets 2, 3, 27–34, 53, 55, 214–27
- Gamma 126
- government 2, 3, 13, 20, 25, 27, 30, 31, 35, 44, 49, 53, 171, 172, 195, 196, 222, 241, 243; intervention 2, 3, 8, 10, 47, 176, 176–87, 191, 197, 222, 234–43; storage 172, 173
- grade spread 237
- guaranteed minimum price 125
- Hammu-Rabi 23
- harvest issues 152, 153, 170–92
- hedge: effectiveness 2, 32, 43, 55, 57, 80–101, 117, 119, 121, 166, 193, 205, 216, 218, 220, 221, 240, 242; objectives 82; ratio 82, 126, 127, 147–8; timing 82
- hedged-to-arrive contracts 85, 129, 154, 162
- hedging 2, 3, 16, 24, 25, 42, 43, 50, 55, 56, 80–127; benefits 94, 95; evaluation 154–69; risks 99–101; strategies 80–144, 148–69; tactics 93, 94, 145–69
- hoarding 3, 9–11, 16, 29, 36–41, 52, 72, 178–81
- hogs 226
- identity preservation 61, 70, 153, 184, 190
- imports 8, 12, 27, 32, 33, 38–41, 48, 50, 65, 72, 186
- index futures 226, 227
- India 9, 38, 43, 53, 243
- inflation 13, 25, 57, 167, 168, 184, 196–8, 222
- information 8, 30, 41, 146, 147, 181, 184, 185, 220, 228
- infrastructure 21, 33, 174, 187, 222, 223, 233, 235
- initial margins 28, 76, 100, 110, 129, 161, 221
- institutional catering 2, 13, 25, 38, 172, 173, 222
- insurance 34, 48, 67, 215
- integration 1, 4–25
- Intercontinental Exchange 195, 218
- intervention 2, 3, 8, 9–11, 47, 176, 176–87, 191, 197, 222, 234–43
- in-the-money (ITM) 106
- intrinsic value 106–108
- inventory: management 21, 27–43, 64, 70, 95, 104, 173, 182, 187, 190, 223, 231, 232, 238–40; multiplier effect 21
- inverse markets *see* backwardation
- just-in-time (JIT) ix, 21, 234
- Kansas 27, 53
- Kappa 109
- knock in 139
- knock out 139
- law 2, 22–5, 53, 54, 60, 66, 73, 190, 222, 233
- leverage 78, 87
- liquidity 6, 8, 9, 20, 28–35, 42–55, 81, 87, 104, 109, 137, 141, 148–9, 218, 220, 222, 232, 239, 240
- locality decisions 20, 31, 33, 57
- logistics 21, 48, 130, 174, 182–9, 223, 233, 235
- long position 58, 59, 74–8
- lot feeders 226, 227
- maintenance margins 76, 86
- margin: calls 76, 8; margin settlement 60, 61, 68
- marked-to-market 12, 73
- market: depth 8, 29, 220; efficiency 2, 3, 6, 9, 25, 31, 32, 43, 81, 100, 106, 130, 151, 153, 182, 185, 188, 189, 190, 199, 200, 212, 214, 217, 220, 222, 224, 228, 230, 232, 234, 240; failure 2–7, 51, 223, 224, 232, 243; information 8, 9, 30, 41, 147–8, 181, 184, 185, 220, 228; liquidity *see* liquidity; maker 108;

- manipulation 220, 243; position 2, 13, 15, 24, 44, 50, 55, 58–64, 72–9, 80–2, 148, 153–69; reform 243; squeeze 220, 221; strength 8; valuation 12, 60, 61, 73–9
- maximum price contracts 125, 126, 157–67
- meat 225
- merchant: hedging 85, 162, 163; positions 60–79; strategies 85, 162, 163
- MF Global 222
- milk 225
- minimum price contracts 124, 125, 154–67
- Minneapolis 32, 53, 223
- Mississippi River 26, 57
- monopoly 9, 25, 31, 34, 35, 47, 222
- moving averages 169
- multigrade contracts 67
- neutral position 59
- New York 25–7, 133, 223
- novation 78, 80, 220
- offer 8, 10, 20, 22–24, 29
- oligopoly 222
- on-call contracts 72
- open: interest 78, 79, 220; position 78, 79, 220
- opportunity costs 9, 16, 34, 44, 45, 50–52, 100, 137, 138, 142, 148, 149–50
- options: buyers 102–27; contracts 80, 102–27; hedging 102–27; hedging strategies 114–27, 148–69; liquidity 104; premiums 104–27, 137; price 104–27, 137; sellers 68, 102–27
- OTC products 86, 87, 128–44, 161–7
- out-of-the-money (OTM) 106
- ownership *see* title transfer
- participating forwards 138, 154–8
- perishable products 225–7
- pigs 226
- planning problems 145–6
- pooling 3, 11, 47, 181–92
- position valuation 73–8
- poverty trap *see* commodity poverty trap
- price 1, 9–13, 30, 31; controls 1, 9, 13, 15, 19, 22, 31, 45, 53, 222; discrepancy 229–32; distortions 220–2, 239, 240; enhancement 124, 153–67, 242; frequency *see* price skewness; functions 1, 30, 31; hedging 2, 3, 16, 24, 25, 42, 43, 50, 55, 56, 80–127; manipulation 220–7; momentum 169; rate of change (ROC) 169; risk 44–57; skewness 4, 15–22, 37, 47, 50–52, 82, 100, 148, 168, 176, 214, 241; spreads 235–40; stability 104, 214; taking 11, 19, 47, 170–92; volatility 12, 15–22, 29, 57, 100, 109, 127, 136, 140, 176, 194, 212–14, 224, 242
- pricing 11–14
- processor 6–8
- product: risk 10, 19, 20, 22, 170–92; shortages 2, 16–21, 28–41, 65, 66, 83, 99, 123, 124, 152, 178–81, 184, 186, 194, 210, 222; substitution 71; surpluses 5, 6, 9, 15, 19, 20, 26–43, 65, 66, 99, 151, 168, 177, 181, 189
- pulse crops 43, 217
- put buyers 102–27
- put-call parity 106
- put options 102–27
- quality 12, 16, 18, 23, 31, 34, 42, 49, 51, 53, 55, 70, 124, 151, 172–4, 177, 178, 184, 185, 188, 225; control 18, 20, 34, 69, 170–92, 234
- regulation 23–25, 31, 38, 64, 132, 143, 171, 191, 198, 217, 222, 235
- relative strength index 169
- Renminbi 194 *see also* Yuan
- reserve stocks 13, 16, 38, 41, 45, 172, 173, 222
- reverse cash and carry 231, 232, 235
- Rho 110
- risk 1, 7, 44–57; management 44–57; tradeoffs 1, 3, 50, 51
- risk: return ratio 212–14
- rollovers 70, 71; hedging 84, 137, 142, 148

- roundturning 76, 77, 87–93
- Russia 18, 38
- segregation 32, 33, 40, 70, 152, 153, 174, 183–6
- sell futures 76
- selling strategies 87–90, 117–22, 150–7, 160–5, 170–92
- settlement price 61
- short position 59, 74–78
- Singapore 233, 243
- skewness *see* price skewness
- slippage 101, 137, 141, 142, 149, 150, 220
- soybeans 229–31
- speculation 3, 6, 7, 8, 13, 16, 19, 20, 24, 29–41, 51, 55, 68, 81, 220, 228, 230, 232, 239
- spot basis 42–3
- spot market 1, 89, 218
- spread: distortion 239, 240; indices 236; trades 216, 228–40
- standard deviation 167
- standardization 28, 34, 45, 55, 56, 78, 221
- statutory selling 181–92
- stochastic oscillator 169
- stock feeding 221, 222
- storage 170–92; alternative 124, 153–67, 170–92; hedge 83, 84, 175; problems 153, 170–92; strategies 153–67, 170–92; technology 33, 146, 174, 176, 177, 182
- strategy evaluation 153–67
- strike price 106–27
- subsidies 3, 15, 30, 45, 49, 52, 215, 222
- sugar 32, 43, 56, 61–3, 84, 85, 133, 152, 171, 177, 181–3, 186, 218, 229
- supply 2–13, 18; risk 7
- swaps 128–136, 148–67
- tactics 146–53
- target pricing 147
- tea 219
- technical analysis 168, 169
- tender procurement 13, 25, 38, 41, 64, 173, 222, 244
- Theta 109–10
- time: decay 109, 110; spread 236
- timing 148
- title: retention 63, 64; transfer 61–4, 190
- tobacco 219
- total return swaps 128, 191
- traceability 153, 184
- trade markets *see* commercial trade markets
- tradeoffs 1, 3, 44–53, 64
- transaction costs 100, 215, 216, 230–2, 235
- translation risk 194
- uncertainty 1, 4–8, 11, 14, 16, 18, 21–29, 33–38, 44–57
- USA 3, 18, 27, 38, 49, 52, 67, 100, 104, 128, 129, 180, 193, 219, 222, 223; US Dollar Index 195; US dollars 3, 57, 59, 193–7, 200–2
- valuation 2, 3, 12, 73–8
- value: adding 12, 49; creation 49, 178, 233
- Vega 109
- vertical ownership 1, 2, 6, 22
- warehouse: market 27, 28–36, 39, 40, 99, 189, 219, 224; space 21, 26–41, 64, 70, 95, 104, 173, 182, 187, 190, 223, 231, 232, 238–40
- washouts 68
- wheat 219, 221, 237–9
- Winnipeg 32, 53
- wool 21, 192, 219, 221
- Working, Holbrook 175
- Yuan 194